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GANNETT FLEMING CORDDRY AND CARPENTER INC HARRISBURG PA F/G 13/13  
NATIONAL DAM INSPECTION PROGRAM. SUNRISE LAKE DAM (NDI ID NUMBE--ETC(U)  
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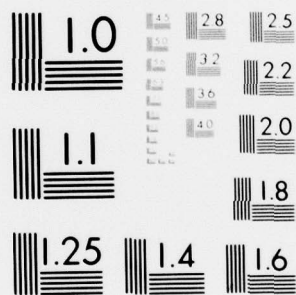
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DELAWARE RIVER BASIN,  
PINE CREEK, LUZERNE COUNTY,  
PENNSYLVANIA.

6 National Dam Inspection Program.

SUNRISE LAKE DAM

(NDI ID Number PA-00556  
DER ID Number 40-216),

WHITE HAVEN POCONOS OWNERS ASSOCIATION, INC.

PHASE I INSPECTION REPORT,

NATIONAL DAM INSPECTION PROGRAM

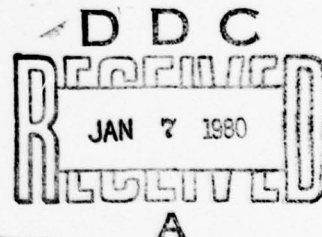
10 Frederick Futchko

Prepared by

GANNETT FLEMING CORDDRY AND CARPENTER, INC.  
Consulting Engineers  
P.O. Box 1963  
Harrisburg, Pennsylvania 17105

For

DEPARTMENT OF THE ARMY  
Baltimore District, Corps of Engineers  
Baltimore, Maryland 21203



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## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

DELAWARE RIVER BASIN  
PINE CREEK, LUZERNE COUNTY  
PENNSYLVANIA

SUNRISE LAKE DAM

NDI ID No. PA-00556  
DER ID No. 40-216

WHITE HAVEN POCONOS OWNERS ASSOCIATION, INC.  
NATIONAL DAM INSPECTION PROGRAM

JULY 1979

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PLATES

<u>Plate</u>	<u>Title</u>
1	Location Map.
2	General Plan.
3	Embankment Sections.
4	Spillway Details.
5	Outlet Works.

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## APPENDICES

### Appendix

### Title

A	Checklist - Engineering Data.
B	Checklist - Visual Inspection.
C	Hydrology and Hydraulics.
D	Photographs.
E	Geology.

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam: Sunrise Lake Dam  
NDI ID No. PA-00556/DER ID No. 40-216

Owner: White Haven Poconos Owners  
Association, Inc.

State Located: Pennsylvania

County Located: Luzerne

Stream: Pine Creek

Date of Inspection: 12 June 1979

Inspection Team: Gannett Fleming Corddry and Carpenter, Inc.  
Consulting Engineers  
P.O. Box 1963  
Harrisburg, Pennsylvania 17105

*[Cont'd from pp 1 & 2.]*

Based on visual inspection, available records, calculations, past operational performance, and according to criteria established for these studies, Sunrise Lake Dam is judged to be in good condition. The spillway capacity is rated as adequate. The spillway can pass the Probable Maximum Flood (PMF) without overtopping of the dam.

The headwall at the conduit outlet is tilted and is considered to be unsatisfactory.

In the absence of stability computations showing that an adequate factor of safety exists, the downstream slope is considered to have a marginal factor of safety because of the steepness of the slope.

The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:



(1) Replace riprap missing at each side of spillway.

(2) Replace headwall at conduit outlet with a structure that is structurally adequate.

(3) Obtain and review the design calculations for the embankment to determine the factor of safety for the existing slope. If the factor of safety is not found to be satisfactory, corrective measures should be designed and implemented immediately. The review should be performed by a professional engineer experienced in the design and construction of dams.

(4) Repair eroded areas on surface of downstream slope and establish adequate vegetal cover at all areas.

(5) Fill all low areas on the top of the dam to the design level of Elevation 1308.0.

(6) Remove brush and trees from upstream slope and from downstream toe.

(7) Locate an alternate route to dam that would allow access during high flow periods.

(8) Make repairs to correct other minor deficiencies described herein.

In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Sunrise Lake Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Sunrise Lake Dam.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the results to determine if remedial measures are necessary.

Submitted by:

GANNETT FLEMING CORDDRY  
AND CARPENTER, INC.



*Frederick Futchko*  
FREDERICK FUTCHKO  
Project Manager, Dam Section

Date: 7 August 1979

Approved by:

DEPARTMENT OF THE ARMY  
BALTIMORE DISTRICT, CORPS OF ENGINEERS

*James W. Peck*  
JAMES W. PECK  
COLONEL, Corps of Engineers  
District Engineer

DATE: 23 August 1979

SUNRISE LAKE DAM



Overview



DELAWARE RIVER BASIN  
PINE CREEK, LUZERNE COUNTY  
PENNSYLVANIA

SUNRISE LAKE DAM

NDI ID No. PA-00556  
DER ID No. 40-216

WHITE HAVEN POCONOS OWNERS ASSOCIATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JULY 1979

SECTION I

PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Sunrise Lake Dam is a homogeneous earthfill embankment 478 feet long and 27 feet high at its maximum section. The embankment has a curved alignment. The outlet works is located near the left abutment and consists of a concrete headwall with a slide gate at the intake, a 36-inch diameter concrete conduit,

and a concrete headwall at the conduit outlet. The hand-wheel for the gate is located on a bridge that extends from the top of the dam into the reservoir area.

> A concrete chute spillway is located near the right abutment of the dam. The approach channel is the reservoir area. The ogee crest is 105 feet long and 7.25 feet lower than the design elevation of the top of the dam. A steep chute 105 feet wide conveys spillway flow into a stilling basin. The exit channel, just downstream from the end of the stilling basin, has a bottom and side slopes that are grouted stone. A grouted stone channel obstruction about 4 feet high is located near the end of the grouted stone exit channel. Its purpose is to control tailwater levels in the stilling basin. The various features of the dam are shown on the Plates at the end of the report and on the Photographs in Appendix D.

b. Location. The dam is located on Pine Creek, approximately 3.2 miles north of White Haven, Pennsylvania, with coordinates N41°06'25" and W75°45'35" in Luzerne County, Pennsylvania. Pine View Dam is located upstream from Sunrise Lake Dam on an unnamed tributary to Pine Creek, 1.3 miles northeast of Sunrise Lake Dam. A location map is shown on Plate 1.

c. Size Classification. Small (27 feet high, 209 acre-feet).

d. Hazard Classification. Significant hazard. Downstream conditions indicate that a significant hazard classification is warranted for Sunrise Lake Dam. (Paragraphs 3.1e and 5.1c (5)).

e. Ownership. White Haven Poconos Owners Association, Inc., White Haven, Pennsylvania.

f. Purpose of Dam. Recreation.

g. Design and Construction History. Sunrise Lake Dam was constructed in 1962. The original design was performed by L.A. Achterman, Jr., of East Stroudsburg, Pennsylvania. The Contractor for the original construction was Central Pennsylvania Quarry, Stripping, and Construction Company. Construction was completed by September 1962.

On November 8, 1962, the spillway of Sunrise Lake Dam failed completely. The failure occurred at a time when there were no unusual rainfall conditions. Subsequently, reports concerning the failure were prepared by L.A. Achterman, Jr.; Moran, Proctor, Mueser, and Rutledge, Consulting Engineers, New York, New York; and by the Pennsylvania Department of Forests and Waters. The consensus of the studies was that the probable cause of failure was uplift, followed by piping.

The spillway was reconstructed in 1963. The design was performed by Moran, Proctor, Mueser, and Rutledge, Consulting Engineers. The contractor was H.J. Williams Company, Inc., York, Pennsylvania. The new spillway was constructed at approximately the same location as the original spillway. Extensive underdrainage provisions were included for the spillway structures to prevent recurrence of a similar condition. As part of the reconstruction plan, spillway dimensions and elevations were changed, which also required changes in embankment elevations and dimensions. A toe drain was also added along the downstream toe of the embankment.

h. Normal Operational Procedure. The pool is maintained at the spillway crest level with excess inflow discharging over the spillway. Releases from the outlet works, as well as spillway discharges, flow downstream to the confluence with the Lehigh River.

### 1.3 Pertinent Data.

a.	<u>Drainage Area.</u> (square miles)	3.4
b.	<u>Discharge at Damsite.</u> (cfs.)	
	Maximum known flood at damsite	Unknown
	Outlet works at maximum pool elevation	190
	Spillway capacity at maximum pool elevation	
	Design Conditions	8,320
	Existing Conditions	6,660
c.	<u>Elevation.</u> (Feet above msl.)	
	Top of dam	
	Design Conditions	1308.0
	Existing Conditions	1307.0

c.	<u>Elevation.</u> (cont'd)	
	Maximum pool	
	Design Conditions	1308.0
	Existing Conditions	1307.0
	Normal pool (spillway crest)	1300.75
	Upstream invert outlet works	1284.5
	Downstream invert outlet works	1283.5
	Streambed at toe of dam	1279.6
d.	<u>Reservoir Length.</u> (miles)	
	Normal pool	0.25
	Maximum pool	0.53
e.	<u>Storage.</u> (acre-feet)	
	Normal pool	49
	Maximum pool	209
f.	<u>Reservoir Surface.</u> (acres)	
	Normal pool	14
	Maximum pool	32
g.	<u>Dam.</u>	
	<u>Type</u>	Homogeneous earthfill.
	<u>Length</u> (feet)	478
	<u>Height</u> (feet)	27
	<u>Topwidth</u> (feet)	Varies, 7 to 8.5
	<u>Side Slopes</u>	
	Design	
	Upstream	1V on 2H
	Downstream	1V on 2H
	Existing Conditions	
	Upstream	1V on 2.3H (Average)
	Downstream	1V on 1.7H (Average)
	<u>Zoning</u>	None.
	<u>Cut-off</u>	Earthfill in trench.
	<u>Grout Curtain</u>	None.

h.	<u>Diversion and Regulating Tunnel.</u>	None.
i.	<u>Spillway.</u>	
	<u>Type</u>	Concrete chute.
	<u>Length of Weir (feet)</u>	105.0
	<u>Crest Elevation</u>	1300.75
	<u>Upstream Channel</u>	Reservoir, vertical concrete walls.
	<u>Downstream Channel</u>	Chute and stilling basin discharge into stream channel.
j.	<u>Regulating Outlets.</u>	
	<u>Type</u>	One 36-inch diameter reinforced concrete pipe (RCP).
	<u>Length (feet)</u>	100
	<u>Closure</u>	Slide gate at upstream end.
	<u>Access</u>	Steel and timber bridge from top of dam.



## SECTION 2

### ENGINEERING DATA

#### 2.1 Design.

a. Data Available. Engineering data available for review were limited to the following: permit application reports for both the original construction and for the spillway reconstruction; reports discussing the failure of the original spillway prepared by L.A. Achterman, Jr., Civil Engineer; Moran Proctor Mueser and Rutledge, Consulting Engineers; and by the Pennsylvania Department of Forests and Waters; a report by Moran Proctor Mueser and Rutledge on the preliminary design for spillway reconstruction; and miscellaneous correspondence. The present Owner, White Haven Poconos Owners Association, Inc., had no design information available. It was learned that additional design data is available in the files of Mueser Rutledge Johnston and Desimone, Consulting Engineers, 415 Madison Avenue, New York, New York, who were the engineers for the spillway reconstruction for the previous Owner, Atlas Chemical Industries, Inc., Wilmington, Delaware. Mueser Rutledge Johnston and Desimone stated that all their information could be made available provided that their former client had no objections and provided that a member of the inspection team travelled to their storage facilities and personally selected information considered pertinent. Furnishing copies of specific information requested by the inspection team was not considered satisfactory by the engineers. Consequently, their information was not available for the Phase I inspection report.

b. Design Features. The project is described in Paragraph 1.2a. the various features of the dam are shown on the Plates at the end of this report and on the Photographs in Appendix D. The embankment is shown on Plates 2 and 3 and on Photographs A, B, C, and D. The spillway is shown on Plates 2 and 4 and on Photographs D, F, G, and H. The outlet works is shown on Plate 5 and on Photograph E.

c. Design Considerations. There are insufficient data available to assess the design.

## SECTION 2

### ENGINEERING DATA

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c. Design Considerations. There are insufficient data available to assess the design.

## 2.2 Construction.

a. Data Available. Construction data available for review were limited to the following: construction specifications for both the original work and for the spillway reconstruction; contractor's progress reports; and reports of construction inspection performed by the Commonwealth of Pennsylvania.

b. Construction Considerations. The available information indicates that the dam was constructed in accordance with the approved plans and specifications. The Commonwealth of Pennsylvania reported that the work was performed in a satisfactory manner.

2.3 Operation. There are no formal records of operation. The Owner did not report any problems having occurred over the operational history of the dam after the spillway was reconstructed in 1963. No damage or problems were reported to have occurred during Tropical Storm Agnes, which is believed to be the flood of record for the dam.

## 2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dam Safety, Obstructions, and Storm Water Management, Department of Environmental Resources, Commonwealth of Pennsylvania. The Owner made available the caretaker for information during the visual inspection. He also researched his files for information at the request of the inspection team.

b. Adequacy. The type and amount of available design data and other engineering data are limited, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data.



### SECTION 3

#### VISUAL INSPECTION

##### 3.1 Findings.

a. General. The overall appearance of the dam is good. Deficiencies were observed as noted below. A sketch of the dam with the location of deficiencies is presented in Appendix B on Plate B-1. Survey information acquired for this report is summarized in Appendix B. On the day of the inspection, the pool was at spillway crest.

b. Embankment. The riprap on the upstream slope is generally in good condition (Photograph A), but riprap was missing at each side of the spillway. Crownvetch covers some areas of the riprap, and there were a few small shrubs on the upstream slope. The measured topwidth varied from 7 feet to 8.5 feet. The top of the dam and the downstream slope are covered with crownvetch about 30 inches high (Photograph B). The downstream slope appeared to be in good condition except along the right wall of the spillway chute, where there has been some surface erosion along a footpath (Photograph C). In this area, from the right wall of the spillway chute to the right abutment, the vegetal cover on the downstream slope is sparse (Photograph C). There are some large trees and brush growing just beyond the toe of the embankment to the left of the spillway (Overview and Photograph D).

No wet areas or uncontrolled seepage were observed during the visual inspection. The toe drain outlet along the spillway chute right wall was dry. Two toe drain outlets located near the conduit outlet had slight, clear discharges. Accumulations of "yellowboy" were present at each of those outlets.

A survey performed as part of this inspection revealed that most of the top of the embankment is above design elevation (Elevation 1308), but that there are three low areas. The minimum elevation of the top of the dam is Elevation 1307, which is one foot lower than the design elevation. The survey also showed that the upstream slope has an average slope of 1V on 2.3H and that the downstream slope has an average slope of 1V on 1.7H. There was no visible evidence of stability problems at the embankment.

c. Appurtenant Structures. The outlet works appeared to be in fair condition. A steel and timber access bridge for the gate operating mechanism extends from the top of the dam into the reservoir area. The handwheel for the slide gate is located on the bridge deck. Some of the deck planks were deteriorated. The operating mechanism appeared to be in good working order. An inspection of the 36-inch diameter concrete outlet conduit showed it to be in good condition. All joint sealant was intact. The slide gate had some leakage when it was in the fully closed position. The concrete headwall at the downstream end of the conduit was in poor condition (Photograph E). The concrete was partially disintegrated, and the headwall was cracked and tilting. The outlet works channel follows a natural channel in overburden downstream to the stilling basin. Near the end of the outlet channel, a grouted stone obstruction with a 36-inch diameter corrugated metal pipe was constructed across the channel. It appeared that the purpose is to prevent potential erosion due to turbulence in the stilling basin.

The spillway weir, chute, and stilling basin appeared to be in generally good condition (Photographs D, F, and G). The weir had some minor surface scaling (Photograph F), and the right chute wall was cracked at its downstream end. Some of the expansion joint filler in the chute was deteriorated slightly. There were stones and minor amounts of debris in the apron area of the stilling basin (Photograph F). Downstream from the end sill of the stilling basin, the channel bottom and side-slopes are protected by grouted stone riprap (Photograph G and H). Some of this protection had local areas of deterioration, which allowed water to enter at one point and exit farther downstream. A grouted stone obstruction about 4 feet high is located about 60 feet downstream from the stilling basin (Photograph H). Its purpose appeared to be for tailwater control in the stilling basin.

Four capped pipes extending above ground surface were located around the spillway chute (Photograph C) and two others were in the stilling basin. Their purpose could not be determined from the visual inspection. The caretaker did not know their purpose.

Access to most of the dam and to the outlet works would be difficult during periods of significant spillway discharge. There was no means to cross the outlet channel, nor were any alternate access routes apparent.

d. Reservoir Area. Most of the watershed is privately owned. Slopes are generally mild, and there are some swampy areas. Most of the watershed is wooded and undeveloped. Pine View Dam, a 13-foot high earthfill dam, is located on an unnamed tributary to Pine Creek about 1.3 miles upstream from Sunrise Lake Dam. Pine View Dam and its spillway are shown on Photographs J and K. Pine View Dam controls 0.9 square mile of the total 3.4 square miles of watershed of Sunrise Lake Dam.

e. Downstream Conditions. One summer home is located on the right bank above Pine Creek about 0.3 mile downstream from Sunrise Lake Dam. The confluence with the Lehigh River is about 0.4 mile downstream from the dam. A sportsmans' club is located on the left bank of the Lehigh River at the confluence. There are no permanent dwellings between the dam and the confluence. The first permanent dwellings along the Lehigh River downstream from the confluence are apparently about 3.5 miles from the dam at White Haven. Both Pine Creek and the Lehigh River are subject to substantial fishing use from the spring into the summer months.

## SECTION 4

### OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at the spillway crest level with excess inflow discharging over the spillway and into the downstream channel. The outlet works is used to augment streamflow downstream from the dam during low flow periods and to drawdown the pool level for annual maintenance purposes.

4.2 Maintenance of Dam. The dam is visited at least weekly by a caretaker who adjusts the slide gate, if necessary. Inspections of the dam are not made. Brush is cut at regular intervals.

4.3 Maintenance of Operating Facilities. The operating mechanism for the slide gate is maintained as needed. It is operated at least once each year.

4.4 Warning Systems in Effect. The caretaker stated that he was not aware of any emergency operation and warning system.

4.5 Evaluation of Operational Adequacy. The maintenance of the embankment and spillway is generally good. The maintenance of the outlet works is satisfactory. Inspections are necessary to detect hazardous conditions at the dam. An emergency operation and warning system is necessary to mitigate the hazards downstream, should stress become evident at the dam. An access route to the outlet works that could be used during periods of significant spillway discharge is necessary.



## SECTION 5

### HYDROLOGY AND HYDRAULICS

#### 5.1 Evaluation of Features.

a. Design Data. The permit application report for the spillway reconstruction indicates that the spillway can pass the Commonwealth's Curve "C" discharge with a freeboard of 2.8 feet. According to the permit application report for the original construction, the Curve "C" requirement was 3,822 cfs. A rating curve for the existing spillway was not available, but the spillway capacity used in this report is in reasonable agreement with the above data. The permit application report indicates that the stilling basin was designed in accordance with the standards of the U.S. Bureau of Reclamation, and that it would produce a hydraulic jump within its confines at the Curve "C" discharge. The Moran Proctor Mueser and Rutledge report on the preliminary design of the spillway reconstruction indicates that the grouted stone obstruction downstream from the stilling basin was designed to control the jump location at other discharges.

b. Experience Data. No records of maximum pool levels were available. The failure of the original spillway was not related in any way to its hydraulic capacity. Since the spillway reconstruction, there have apparently been no problems. Tropical Storm Agnes is believed to be the flood of record for Sunrise Lake Dam, but the available information was insufficient to estimate the flow.

#### c. Visual Observations.

(1) General. The visual inspection of Sunrise Lake Dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Embankment. The low areas on the top of the dam limit the existing spillway capacity to less than the design capacity.

(3) Appurtenant Structures. The bridge deck leading to the gate mechanism should be maintained in good condition to provide safe access. The leakage at the slide gate is not considered to be serious at the present time. The deteriorating and tilting headwall at the conduit outlet is considered to be a hazard. Failure of this wall could cause blockage of the conduit or erosion damage to the embankment.

The spillway was in good condition except for minor maintenance items. Timely attention to these items would prevent major deterioration of the features.

The relatively poor access to the dam could be a problem if there were a need to open the gate during a period of substantial spillway discharge.

(4) Reservoir Area. Pine View Dam, located 1.3 miles upstream, does affect the hydrology of Sunrise Lake Dam. Its effects have been included in the analysis described hereafter. The records state that the drainage area of Sunrise Lake Dam is 3.5 square miles. Determinations of the drainage area for this study indicate that the drainage area is 3.4 square miles. The assessment of Sunrise Lake Dam is based on existing conditions, and the effects of future development are not considered.

(5) Downstream Conditions. No conditions were observed downstream from the dam that might present significant hydraulic hazard to the dam. Because of the downstream conditions described in Section 3, Visual Inspection, a significant hazard classification is warranted for Sunrise Lake Dam. The records indicate that the 1962 spillway failure did not result in any damage to downstream areas. However, this is not believed to indicate that the dam should be classified as low hazard. When failure occurred, the pool was not at maximum pool levels, and it appears that the failure occurred over many hours. Also, the available mapping indicates that the summer cottage was constructed sometime after 1969.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) for the

size (Small) and hazard potential (Significant) of Sunrise Lake Dam is between the 100-Year Flood and the 1/2 Probable Maximum Flood (PMF). Because of the downstream conditions and the height of the dam, the 1/2 PMF is selected as the SDF for Sunrise Lake Dam.

(2) Description of Model. The watershed was modeled with the HEC-1DB computer program. The HEC-1DB computer program computes a PMF runoff hydrograph and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. The PMF inflow component to Pine View reservoir was routed through the dam and downstream. This was added to the uncontrolled PMF inflow component to Sunrise Lake. The combined flow was routed through Sunrise Lake Dam. Identical methods were used for various percentages of the PMF.

(3) Summary of Results. Pertinent results are tabularized at the end of Appendix C. The analysis reveals that Sunrise Lake Dam can pass the PMF with 0.4 foot freeboard. The dam is rated at its existing top elevation. At its design top elevation, the dam can pass the PMF with 1.4 feet of freeboard.

(4) Spillway Adequacy. The criteria for rating a spillway is presented in Appendix C. Since the spillway can pass the PMF, the spillway capacity of Sunrise Lake Dam is rated as adequate.

An additional analysis was performed to assess the effects of Pine View Dam, were it to fail. During the 1/2 PMF, Pine View Dam was assumed to fail after being overtopped by 0.3 foot. The resulting outflow was routed downstream and added to the uncontrolled 1/2 PMF inflow to Sunrise Lake Dam. The combined inflow was routed through Sunrise Lake Dam. Sunrise Lake Dam can pass this flow with about 2.1 feet of freeboard.

## SECTION 6

### STRUCTURAL STABILITY

#### 6.1 Evaluation of Structural Stability.

##### a. Visual Observations.

(1) General. The visual inspection of Sunrise Lake Dam which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for the various features.

(2) Embankment. Riprap missing at each side of the spillway is an erosion hazard. The sparse vegetal cover on the downstream slope to the right of the spillway is inadequate and creates a potential for surface erosion. Where pedestrian traffic has been frequent, substantial surface erosion has already occurred. The brush on the upstream slope and the trees and brush that are at the downstream toe are undesirable. Although no signs of sloughing or embankment instability were evident at the time of the visual inspection, the downstream slope, which averages 1V on 1.7H, is considered to be too steep without stability computations to show that there is an adequate factor of safety. The design slopes and slope stability computations were not available for the Phase I Inspection Report.

(3) Appurtenant Structures. The tilting of the concrete headwall at the conduit outlet is a stability problem. As noted in Section 5, failure of this headwall could create a serious condition.

There was no evidence of any stability problems for any of the spillway structures. As for the embankment, stability computations were not available for the Phase I Inspection Report. Attention to the maintenance items would prevent major deterioration of the features.

b. Design and Construction Data. No stability analyses were available. Analyses of the stability of the embankment and the various spillway structures are beyond the scope of this study. As discussed in Section 2, the stability analyses are apparently in the files of Mueser Rutledge Johnston and Desimone, Consulting engineers, 415 Madison Avenue, New York, New York.



c. Operating Records. There are no formal records of operation. The original spillway failed shortly after completion of construction. Studies made after the failure indicate that the failure was caused by excessive uplift and by piping. The uplift was apparently the result of both naturally high heads from groundwater and heads resulting from raising the pool level. The original spillway did not have adequate drainage provisions to relieve the uplift. There have been no problems since the spillway was reconstructed.

d. Post-construction Changes. The spillway was reconstructed in 1963. Extensive underdrainage facilities were provided to control uplift. Other changes at the same time included reconstruction of some embankment areas adjacent to the spillway, adding a toe drain to the embankment, and raising the entire embankment by three feet.

e. Seismic Stability. Sunrise Lake Dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone has adequate factors of safety under static loading conditions, it can be assumed safe for any expected earthquake loading. However, since the factors of safety for static loading conditions are not known; the theoretical seismic stability of Sunrise Lake Dam cannot be assessed.

## SECTION 7

### ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

#### 7.1 Dam Assessment.

##### a. Safety.

(1) Based on available records, visual inspection, calculations, and past operational performance, Sunrise Lake Dam is judged to be in good condition. Based on existing conditions, the spillway will pass the PMF with 0.4 foot of freeboard. If the low areas on the top of the dam were filled to the design elevation, the freeboard would be 1.4 feet. Under either condition, the spillway capacity of Sunrise Lake Dam is rated as adequate.

(2) The headwall at the conduit outlet is tilted and is considered to be unsatisfactory.

(3) In the absence of stability computations showing that an adequate factor of safety exists, the downstream slope, which averages 1V on 1.7H, is considered to have a marginal factor of safety.

(4) The visual inspection revealed some deficiencies, which are summarized below for the various features.

<u>Feature and Location</u>	<u>Observed Deficiency</u>
<u>Embankment:</u>	
Upstream Slope	Riprap missing at each side of spillway; brush.
Top	Low areas.
Downstream Slope	Surface erosion along right side of spillway; inadequate vegetal cover on portion to right of spillway; trees and brush at toe.
Access	Most of dam inaccessible during periods of high flow.

<u>Feature and Location</u>	<u>Observed Deficiency</u>
<u>Outlet Works:</u>	
Bridge	Deck deteriorated.
Slide Gate	Slight leakage.
Headwall at Conduit Outlet	Concrete disintegrated; headwall tilting.
<u>Spillway:</u>	
Weir	Minor surface scaling.
Chute Slabs	Expansion joint filler deteriorated.
Right Chute Wall	Concrete deteriorated at downstream end.
Grouted Stone Protection	Minor deterioration.

b. Adequacy of Information. The information available is such that an assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations by the Owner will be required.

## 7.2 Recommendations and Remedial Measures.

a. The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

- (1) Replace riprap missing at each side of spillway.
- (2) Replace headwall at conduit outlet with a structure that is structurally adequate.

(3) Obtain and review the design calculations for the embankment to determine the factor of safety for the existing slope. If the factor of safety is not found to be satisfactory, corrective measures should be designed and implemented immediately. The review should be performed by a professional engineer experienced in the design and construction of dams.

(4) Repair eroded areas on surface of downstream slope and establish adequate vegetal cover at all areas.

(5) Fill all low areas on the top of the dam to the design level of Elevation 1308.0.

(6) Remove brush and trees from upstream slope and from downstream toe.

(7) Locate an alternate route to the dam that would allow access during high flow periods.

(8) Make repairs to correct other minor deficiencies described herein.

b. In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Sunrise Lake Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Sunrise Lake Dam.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the results to determine if remedial measures are necessary.

DELAWARE RIVER BASIN  
PINE CREEK, LUZERNE COUNTY  
PENNSYLVANIA

SUNRISE LAKE DAM

NDI ID No. PA-00556  
DER ID No. 40-216

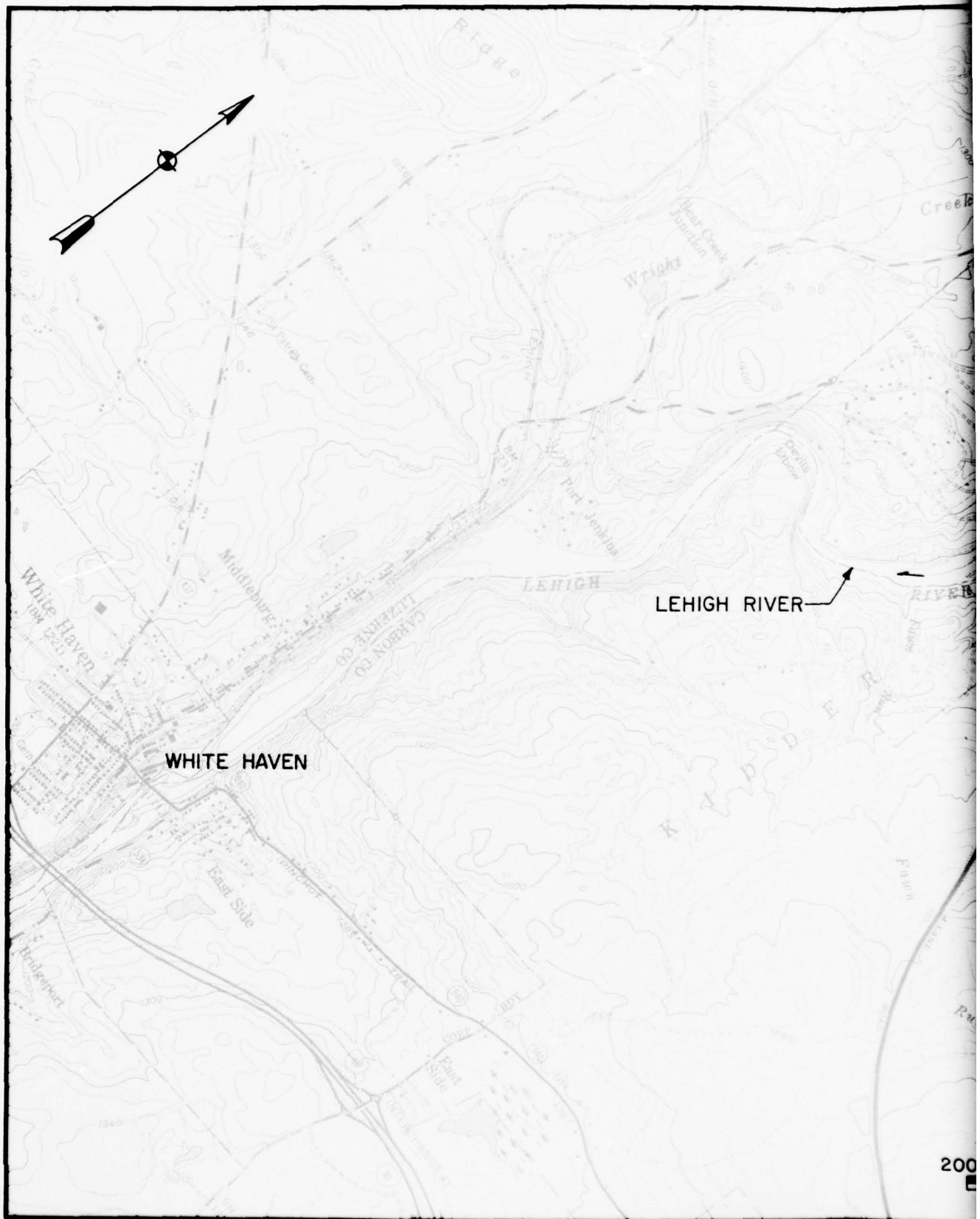
WHITE HAVEN POCONOS OWNERS ASSOCIATION, INC.

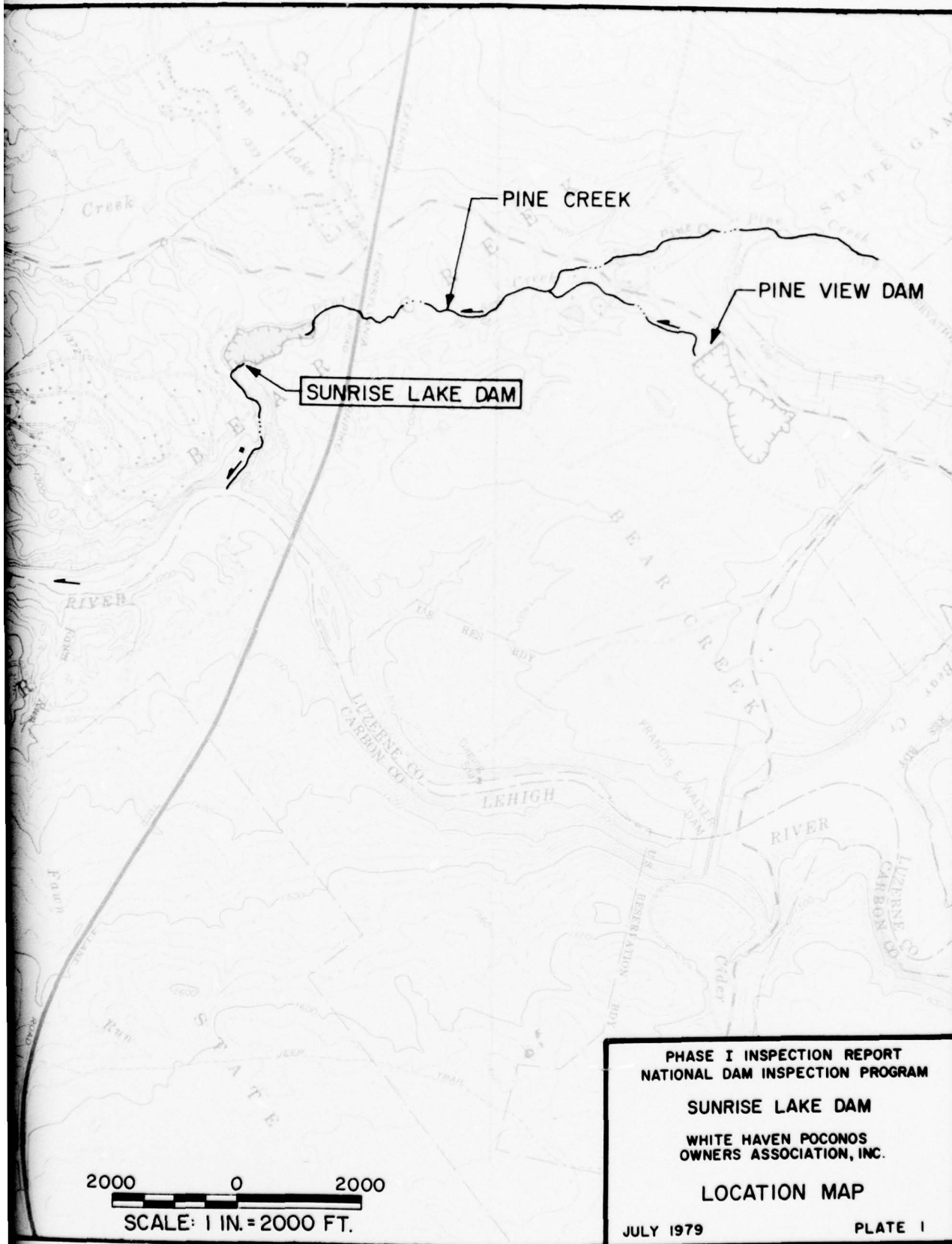
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NATIONAL DAM INSPECTION PROGRAM

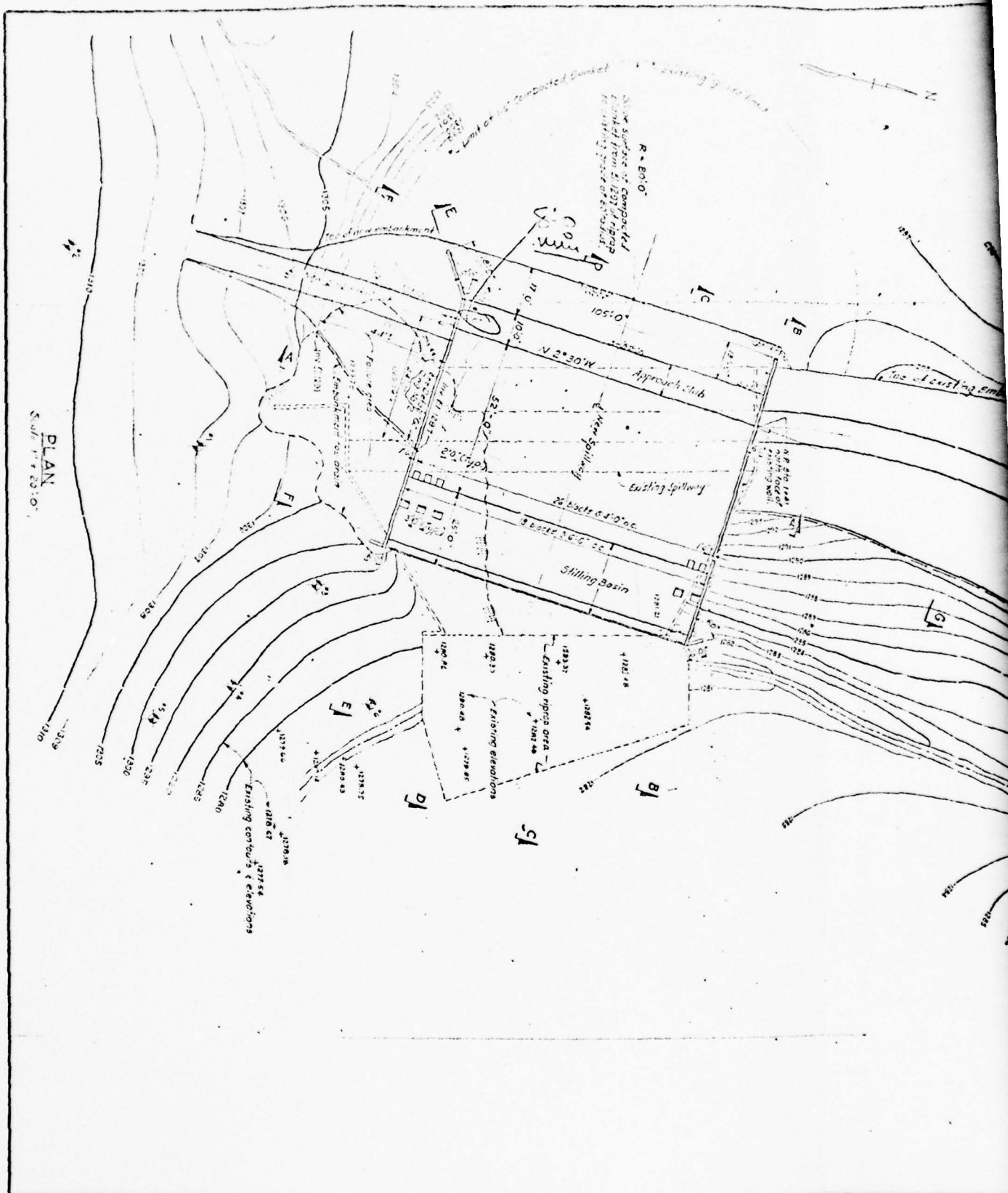
JULY 1979

PLATES

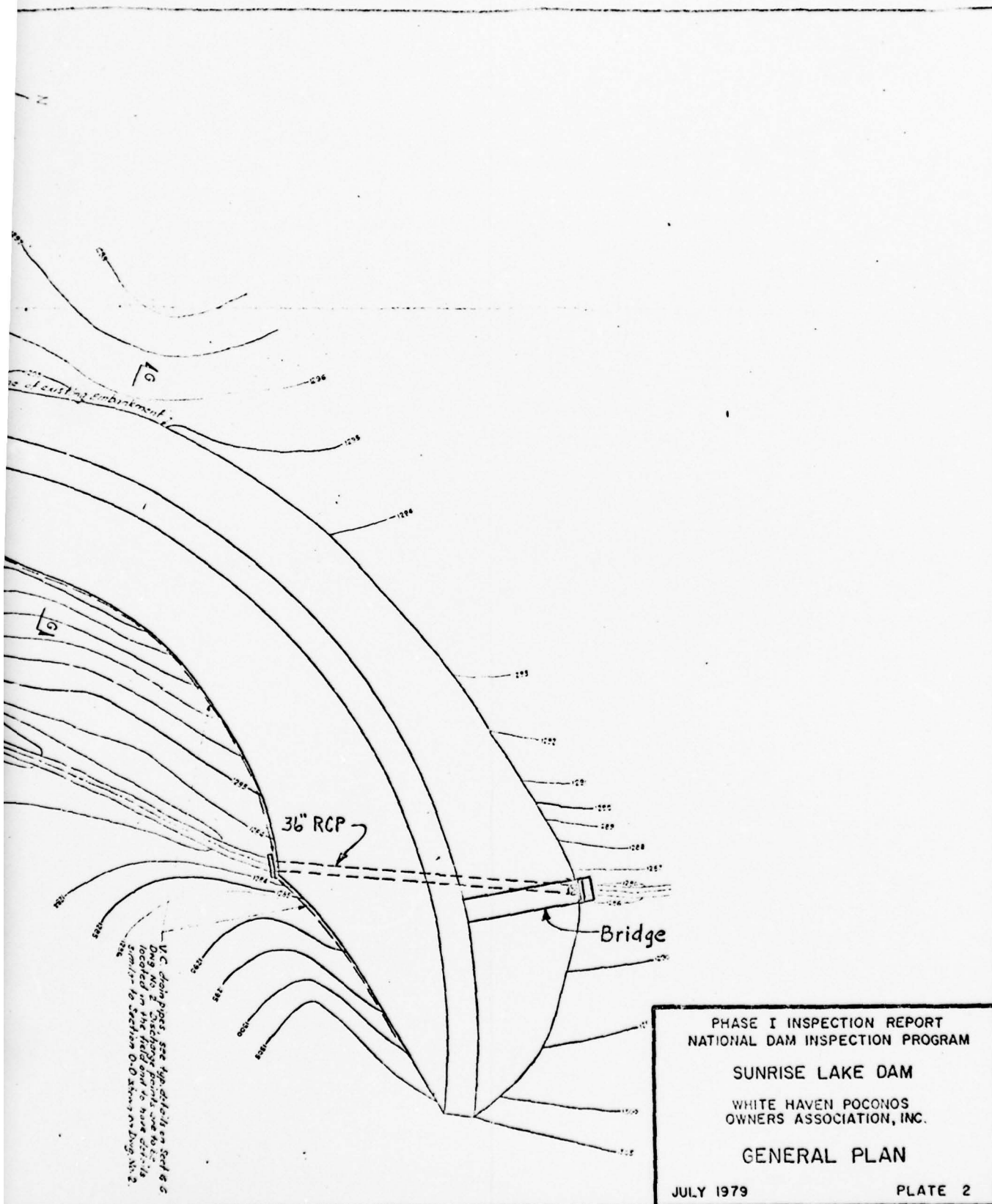


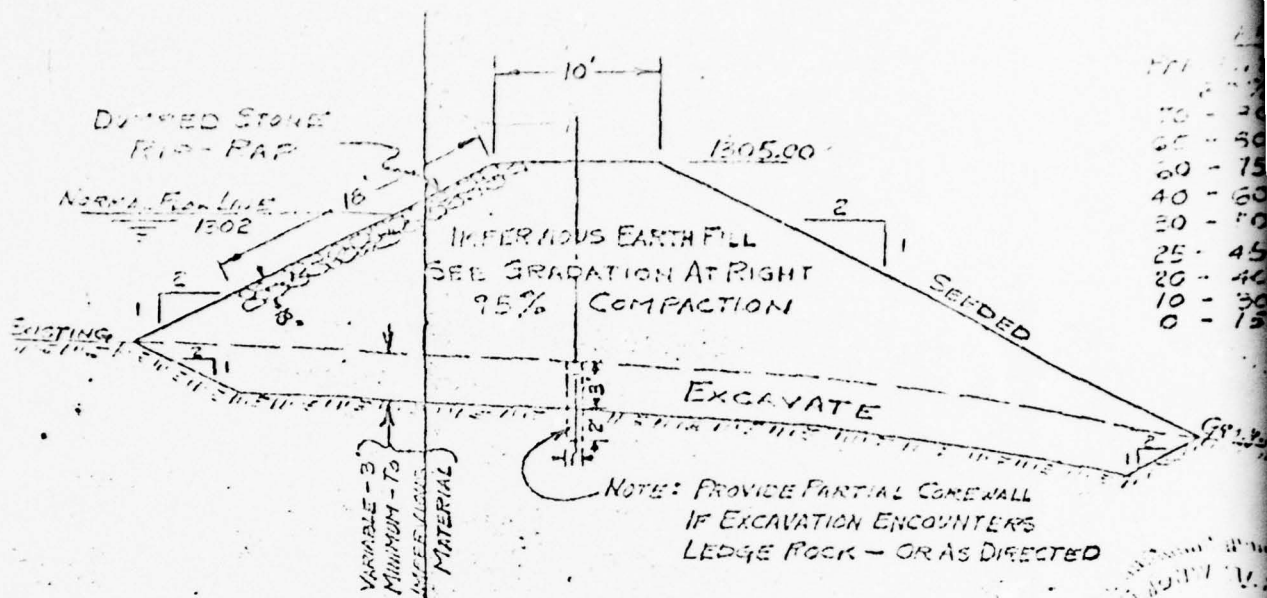




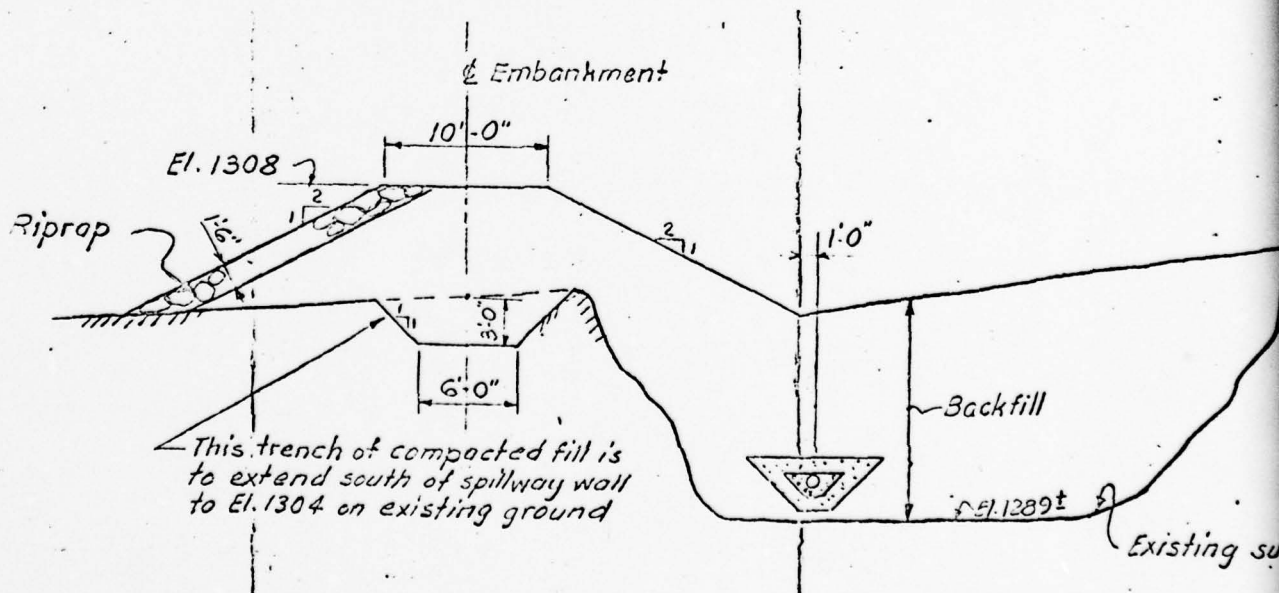






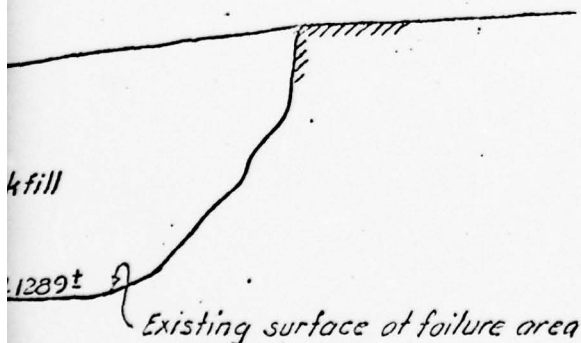
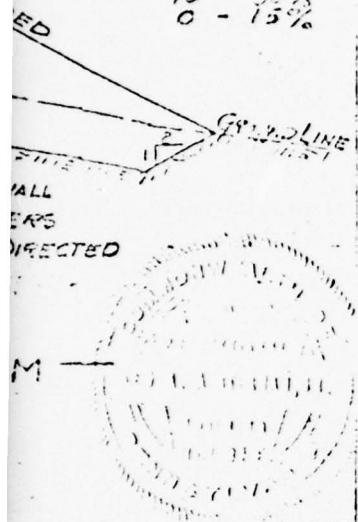


— TYPICAL CROSS SECTION OF DAM —  
SCALE: 1" = 10'



SECTION F-F

EMPAVORATED GROUNDWATER - DAM FILL		
PERCENTAGE BY WEIGHT PASSING		SIZE
100 - 100%	FAIRLY	No. 4 MESH (None Larger Than Nominal)
75 - 80%		No. 8 MESH
65 - 80%		No. 16 MESH
60 - 75%		No. 32 MESH
40 - 60%		No. 60 MESH
30 - 50%		No. 100 MESH
25 - 45%		No. 200 MESH
20 - 40%		No. 270 MESH
10 - 30%		0.025 mm
0 - 15%		0.005 mm



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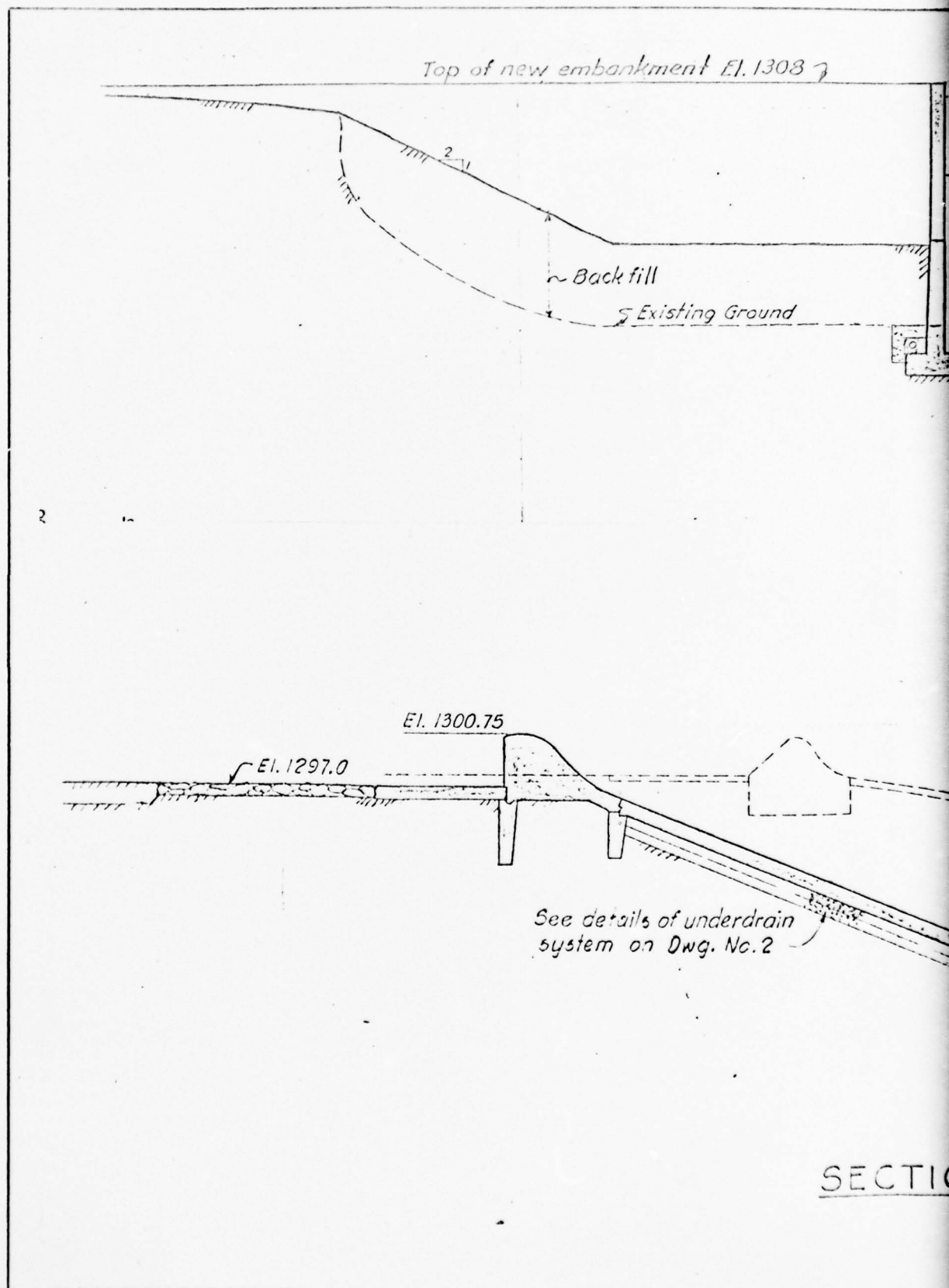
SUNRISE LAKE DAM

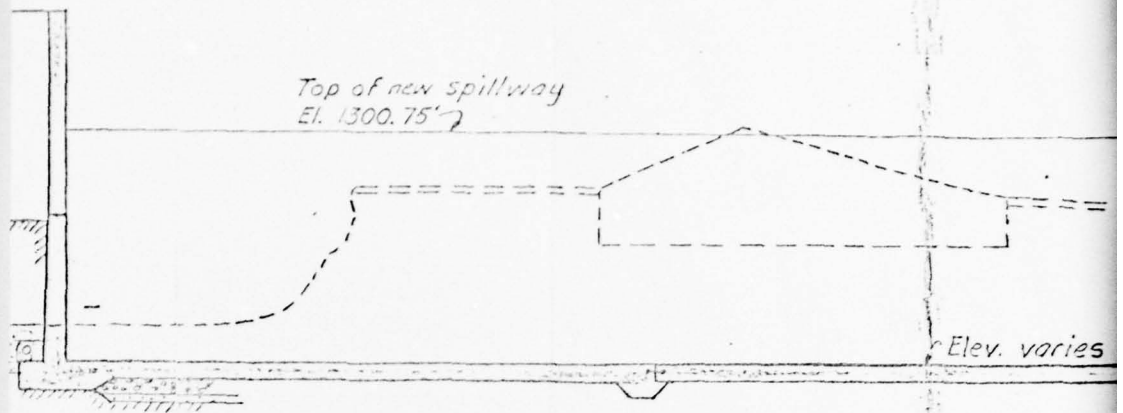
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OWNERS ASSOCIATION, INC.

EMBANKMENT SECTIONS

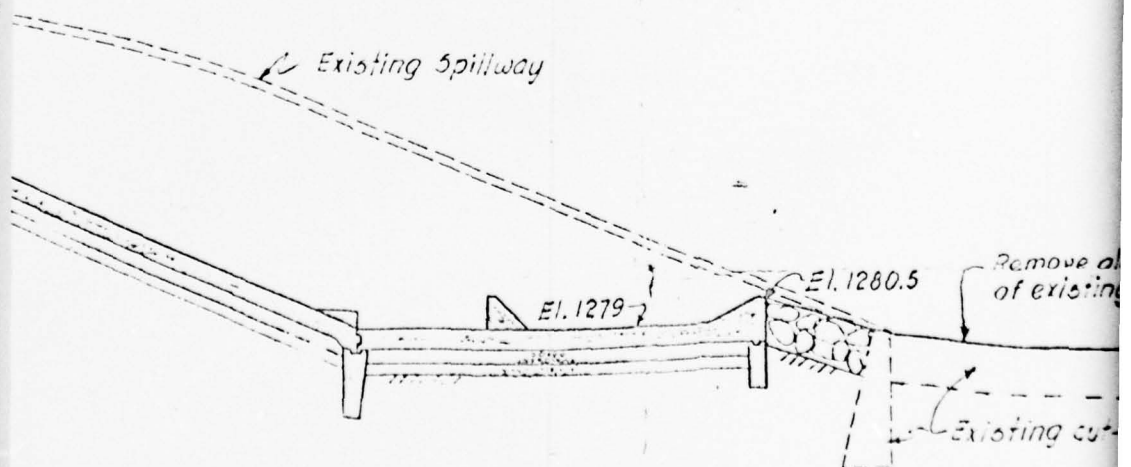
JULY 1979

PLATE 3



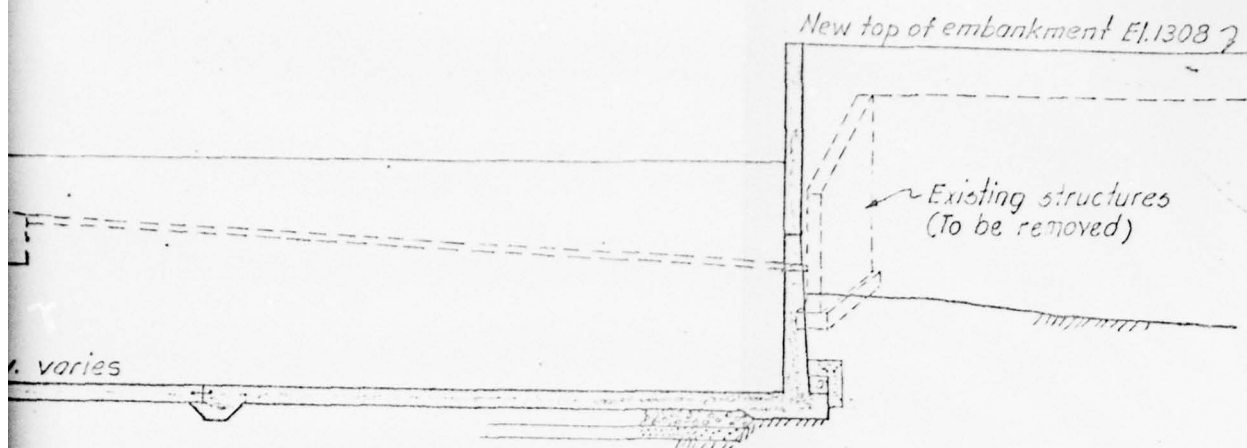


SECTION A-A



SECTION C-C





40-216-A-1

FILE NUMBER

RECEIVED IN THE OFFICE OF THE WATER & POWER

El. 1286

move all debris to surface  
existing riprap (Typ.)

ing cut-off wall & riprap to remain

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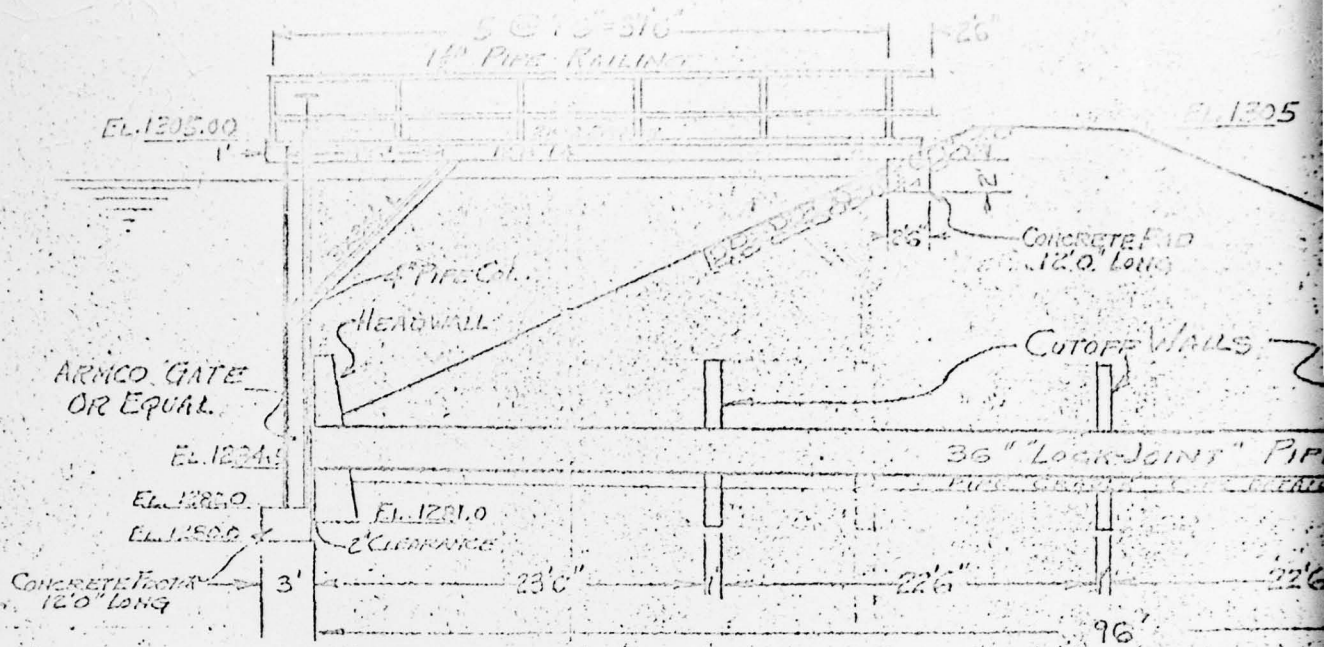
SUNRISE LAKE DAM

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OWNERS ASSOCIATION, INC.

SPILLWAY DETAILS

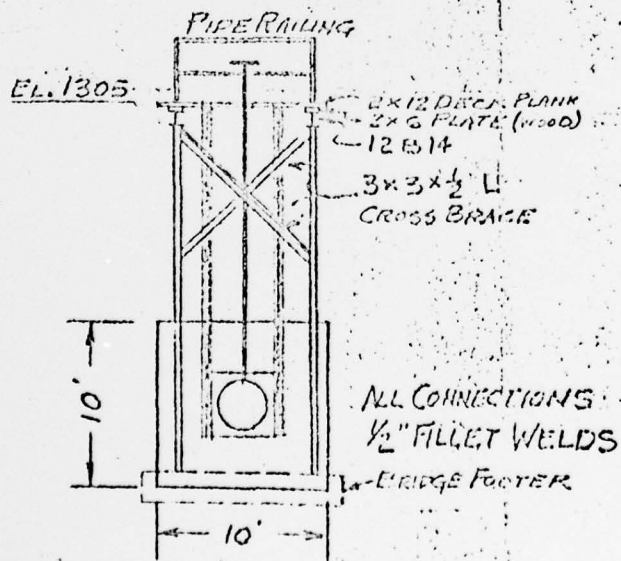
JULY 1979

PLATE 4

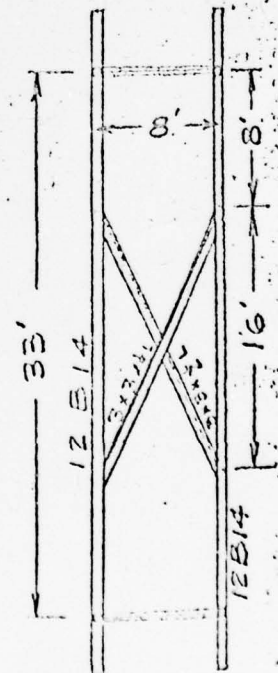


NOTE: HEADWALL & CUTOFF WALLS  
REINFORCING - NO. 4 12" O.C.  
BOTH WAYS.

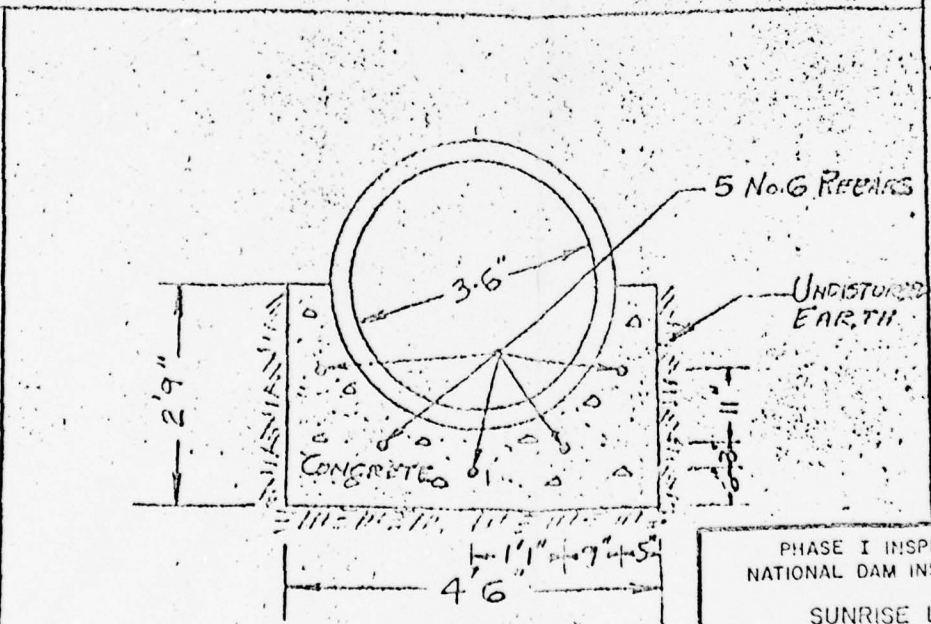
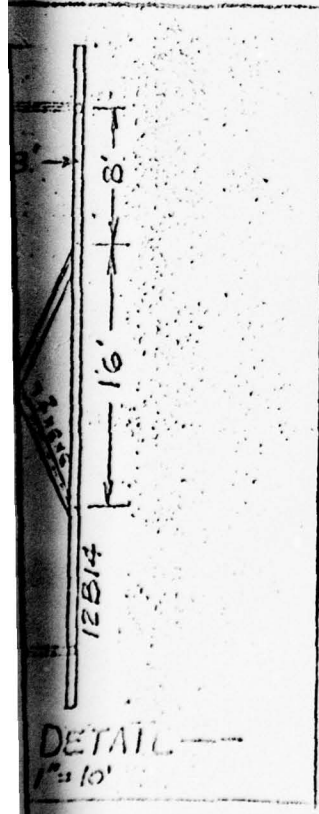
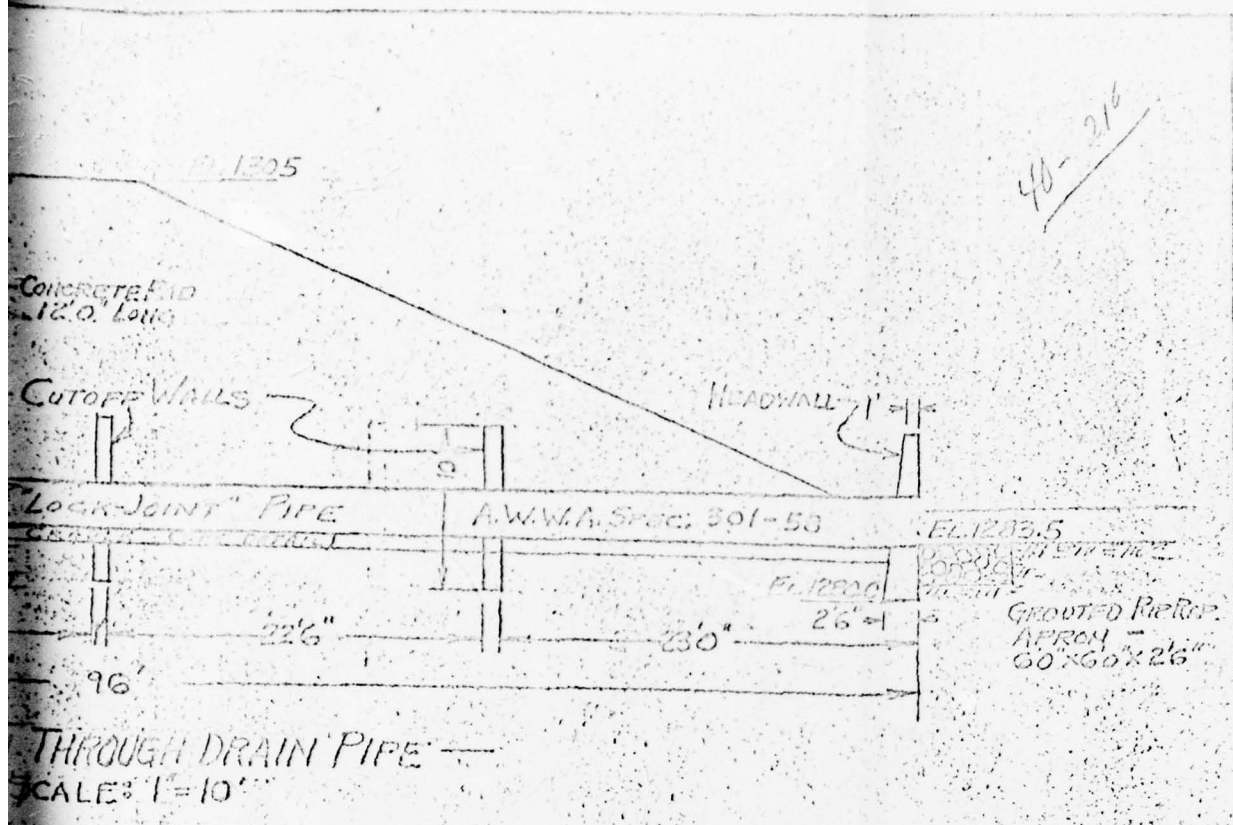
SECTION THROUGH DRAIN  
SCALE: 1" = 10'



ELEVATION - HEADWALL  
SCALE: 1" = 10'



FRAMING DETAIL  
SCALE: 1" = 10'



NOTE: REBAR TO BE CONTINUOUS THROUGH CUTOFF WALL & INTO HEADWALLS - PROVIDE KEY IN CUTOFF WALLS & HEADWALLS

PIPE CRADLE  
SCALE: 1/2"=10'

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

SUNRISE LAKE DAM

WHITE HAVEN POCONOS  
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OUTLET WORKS

JULY 1979

PLATE 5

DELAWARE RIVER BASIN  
PINE CREEK, LUZERNE COUNTY  
PENNSYLVANIA

SUNRISE LAKE DAM

NDI ID No. PA-00556  
DER ID No. 40-216

WHITE HAVEN POCONOS OWNERS ASSOCIATION, INC.

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

JULY 1979

APPENDIX A

CHECKLIST - ENGINEERING DATA

## CHECKLIST

## ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION  
PHASE INAME OF DAM: Sunrise Lake DamNDS ID NO.: PA-00556 DER ID NO.: 40-246Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	Drawings available for original design and for new spillway. See Plates 2 through 5.
REGIONAL VICINITY MAP	See Plate 1.
CONSTRUCTION HISTORY	Constructed 1962. Spillway failed November 1962. Spillway reconstructed 1963.
TYPICAL SECTIONS OF DAM	See Plate 3.
OUTLETS: Plan Details Constraints Discharge Ratings	Plans and details available. See Plate 5. No discharge ratings.



## ENGINEERING DATA

Sheet 2 of 4

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None.
DESIGN REPORTS	Three reports discussing original spillway design with respect to spillway failure. Permit application reports available.
GEOLOGY REPORTS	Six test pit logs on Drawings. Discussion of conditions at spillway in design reports.
DESIGN COMPUTATIONS: Hydrology and Hydraulics Dam Stability Seepage Studies	Designed for Curve "C" with freeboard. No stability or seepage studies in files. Additional information in files of Mueser Rutledge Johnston and Desimone, 415 Madison Ave., N.Y., N.Y.
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	Six test pit logs. Gradation data for embankment materials.
POSTCONSTRUCTION SURVEYS OF DAM	None since spillway reconstruction.

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	Within impoundment area. Mixture of clay, sand, and gravel.
MONITORING SYSTEMS	None.
MODIFICATIONS	Spillway reconstructed 1963.
HIGH POOL RECORDS	None.
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	See design reports.
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	Spillway failure by uplift and piping in 1962. Three reports describing failure.

## ENGINEERING DATA

Sheet 4 of 4

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	None.
SPILLWAY: Plan Sections Details	Partial set of drawings for spillway reconstruction.
OPERATING EQUIPMENT: Plans Details	See Plate 5.
PREVIOUS INSPECTIONS Dates Deficiencies	Inspections during construction - no deficiencies noted.

DELAWARE RIVER BASIN  
PINE CREEK, LUZERNE COUNTY  
PENNSYLVANIA

SUNRISE LAKE DAM

NDI ID No. PA-00556  
DER ID No. 40-216

WHITE HAVEN POCONOS OWNERS ASSOCIATION, INC.

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

JULY 1979

APPENDIX B  
CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: Sunrise Lake Dam County: Lucerne State: Pennsylvania

NDS ID No.: PA-99556 DER ID No.: 40-216

Type of Dam: Homogeneous earthfill Hazard Category: Significant

Date(s) Inspection: 12 June 1979 Weather: Clear, windy Temperature: 70°

B . 1

Pool Elevation at Time of Inspection: 1300.8 msl/Tailwater at Time of Inspection: 1279.6 msl

Inspection Personnel:

A. Whitman (GFECC)

D. Ebersole (GFECC)

A. Weiss (Caretaker for White Haven Potomac Owners Association)

D. B. Wilson (GFECC) Recorder



# EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None visible.	Downstream surface of embankment covered with high crownvetch.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Some tilting of outlet works headwall at downstream toe.	See Outlet Works.
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	Surface erosion of downstream slope adjacent to right spillway wall.	Erosion occurs along foot path. Width $\approx$ 5 feet. Depth $\approx$ 1.5 feet max.
CREST ALIGNMENT: Vertical Horizontal	See attached survey data.	
RIPRAP FAILURES	Some riprap missing at each side of spillway.	Carutaker reported cause as vandalism.

# EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	No abnormalities at abutments. Low areas on right side of spillway (See survey data).	
ANY NOTICEABLE SEEPAGE	No wet areas or uncontrolled seepage.	
STAFF GAGE AND RECORDER	None.	
DRAINS	Drains along toe of embankment. No discharge from drain located right of spillway. Slight clear discharge from drains located left of spillway.	Details of drains not available. Drains located left of spillway outlet near outlet works. Some accumulation of yellow bog at outlets.
Downstream Toe of Embankment	Trees located in natural ground along toe of embankment.	Trees up to 12" diameter.

# OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	36" diameter reinforced concrete pipe.	Excellent condition - all joints tight.
INTAKE STRUCTURE	Steel and timber bridge from top of dam to 15-inch handwheel. Slide gate at upstream end of conduit.	Board on bridge broken.
OUTLET STRUCTURE	Concrete headwall at conduit outlet at toe of dam.	Concrete starting to disintegrate. Headwall cracked and tilting away from embankment.
OUTLET CHANNEL	Small dam (≈ 4.5 feet high) at downstream end with 36" diameter CMP.	Small dam is grouted stone. Prevents erosion due to turbulence in stilling basin.
EMERGENCY GATE	Slide gate on upstream end only.	Gate operated easily. Slight leakage in fully closed position.

# UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Generally good condition; some minor surface scaling. Slight deterioration of expansion joint filler.	
APPROACH CHANNEL	Good condition. No obstructions.	
DISCHARGE CHANNEL	Some rock and debris on apron. Area downstream from apron is grouted stone. Four-foot high obstruction 60' downstream.	Rock and debris from vandalism. Some local deterioration of grouted stone. Downstream end of right chute wall cracked.
BRIDGE AND PIERS	None.	
Grouted Stone Channel	Several "springs" observed. Water enters cracks upstream and resurfaces farther downstream.	Caretaker reports "springs" do not exist if there is no spillway flow.

# INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	Possibly six wells in spillway area - no information available to positively identify.	No known readings. Possibly used for dewatering during spillway reconstruction.
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	



# RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Mild.	No evidence of stability problems.
SEDIMENTATION	None observed or reported.	
WATERSHED DESCRIPTION	Generally mild slopes; about 90% wooded; mostly undeveloped; some swampy areas.	Pine View Dam located 1.3 miles upstream on tributary to Pine Creek.

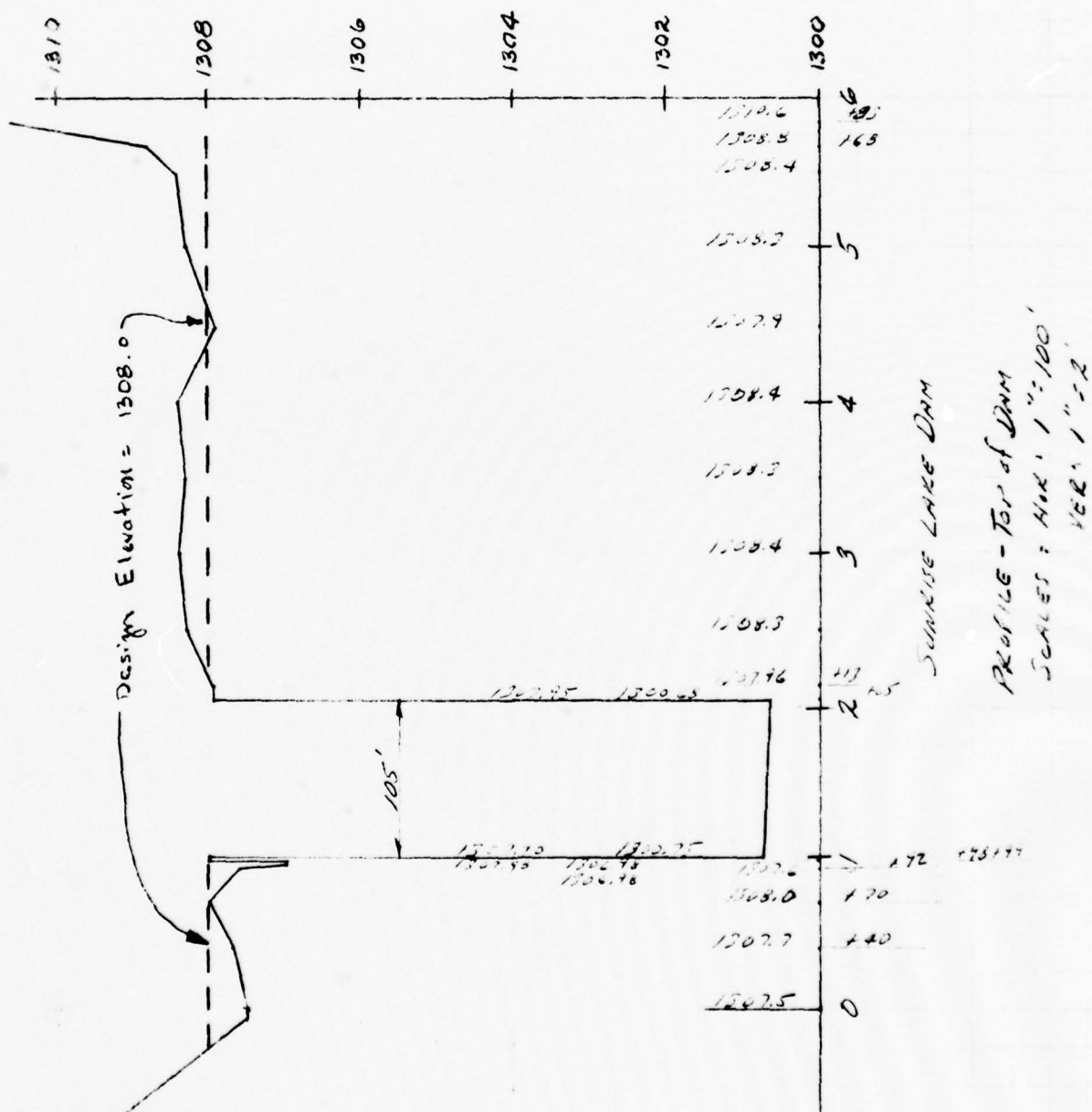
# DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	No obstructions.	Confluence with Lehigh River located 0.4 mile downstream.
SLOPES	Steep.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	One summer home on right bank 0.3 mile downstream. Rod and Gun Club on left bank Lehigh R. at confluence.	Both Pine Creek and Lehigh River get substantial fishing pressure.

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HARRISBURG, PA

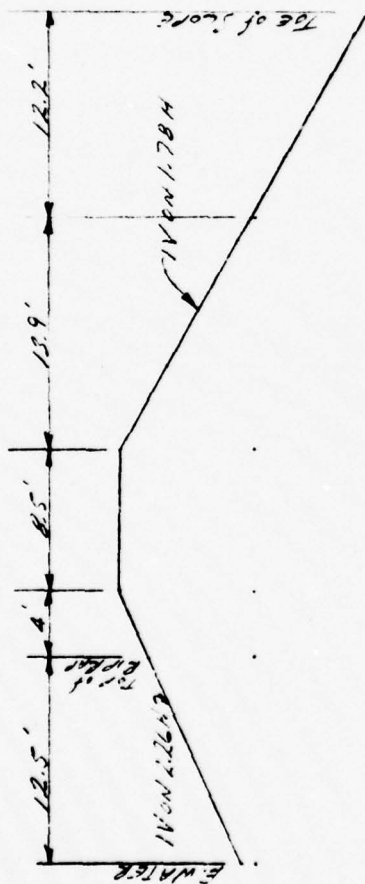
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FOR \_\_\_\_\_  
COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_



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FOR \_\_\_\_\_  
COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_



SUNRISE LAKE DAM

SECTION @ STA 3400  
SCALE: 1"=10'

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HARRISBURG, PA.

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FOR \_\_\_\_\_  
COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_



SUNRISE LAKE DAM

SECTION @ STA 4+50  
SCALE: 1"=10'

1310

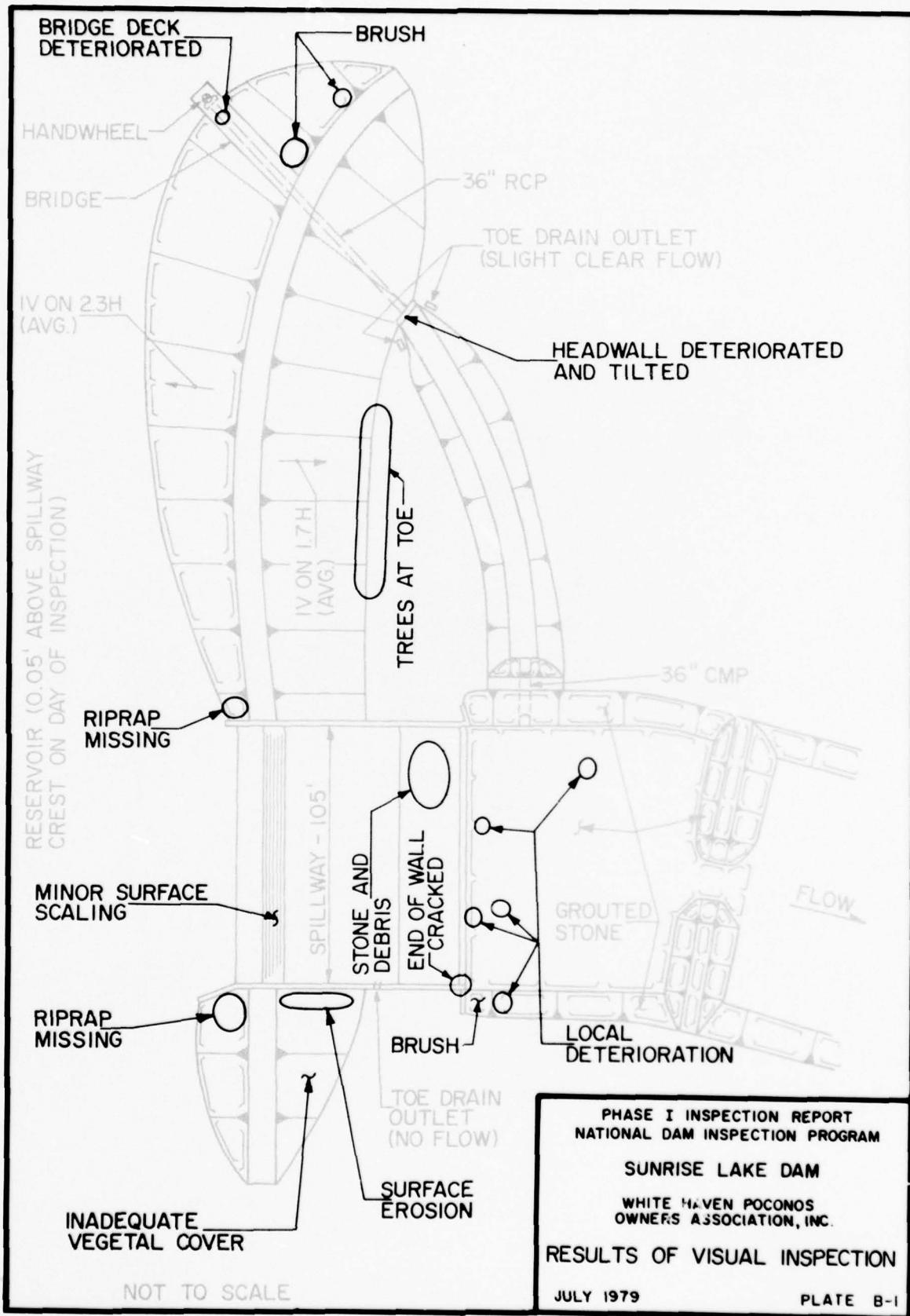
1300

1290

1280

B-11





PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

SUNRISE LAKE DAM

WHITE HAVEN POCONOS  
OWNERS ASSOCIATION, INC.

RESULTS OF VISUAL INSPECTION

JULY 1979

PLATE B-1

DELAWARE RIVER BASIN  
PINE CREEK, LUZERNE COUNTY  
PENNSYLVANIA

SUNRISE LAKE DAM

NDI ID No. PA-00556  
DER ID No. 40-216

WHITE HAVEN POCONOS OWNERS ASSOCIATION, INC.

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

JULY 1979

APPENDIX C  
HYDROLOGY AND HYDRAULICS

## APPENDIX C

### HYDROLOGY AND HYDRAULICS

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

- (a) There is a high hazard to loss of life from large flows downstream of the dam.
- (b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.
- (c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

# APPENDIX C

Delaware River Basin

Name of Stream: Pine Creek

Name of Dam: Sunrise Lake Dam

NDS ID No.: PA-00556

DER ID No.: 40-216

Latitude: N 41° 06' 25" Longitude: W 75° 45' 35"

Top of Dam (~~low spot~~) Elevation: 1308.0 (Design)

Streambed Elevation: 1279.6 Height of Dam: 27 ft

Reservoir Storage at Top of Dam Elevation: 209 acre-ft

Size Category: Small

Hazard Category: Significant (see Section 5)

Spillway Design Flood: Varies from 100 year to 1/2 PMF  
Select 1/2 PMF

## UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
Pine View Dam	1.3	13	161	DER ID No. 40-184

## DOWNSTREAM DAMS

		None		

Delaware River Basin  
 Name of Stream: Pine Creek  
 Name of Dam: Sunrise Lake Dam  
 NDS ID No.: PA-00556  
 DER ID No.: 40-216  
 Latitude: N 41° 06' 25" Longitude: W 75° 45' 35"

# DETERMINATION OF PMF RAINFALL

For Area "A"  
 which consists of Subareas A-1 of 0.9 sq. mile  
A-2 2.5  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Total Drainage Area 3.4 sq. mile

PMF Rainfall Index = 22.3 in., 24 hr., 200 sq. mile

	Hydromet. 40 (Susquehanna Basin)	Hydromet. 33 (Other Basins)
Zone	N/A	<u>2</u>
Geographic Adjustment Factor	_____	1.0
Revised Index Rainfall	_____	<u>22.3</u>

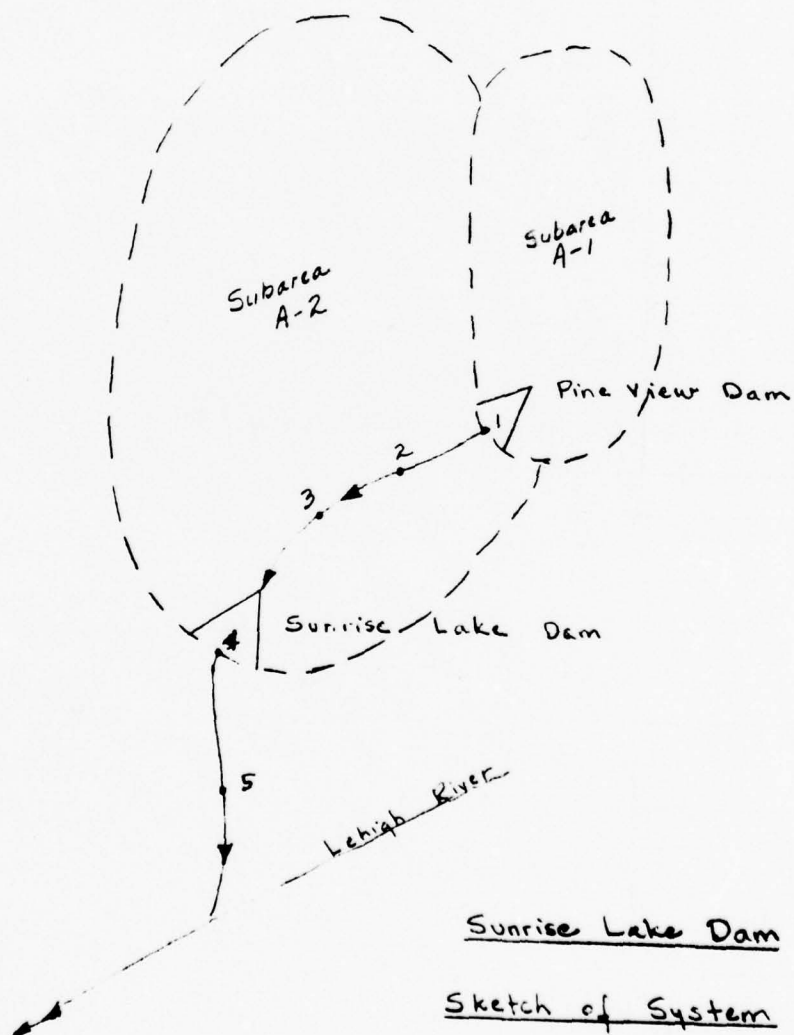
# RAINFALL DISTRIBUTION (percent)

<u>Time</u>	<u>Percent</u>
6 hours	<u>111</u>
12 hours	<u>123</u>
24 hours	<u>133</u>
48 hours	<u>142</u>
72 hours	<u>N/A</u>
96 hours	<u>N/A</u>



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SUBJECT \_\_\_\_\_ FILE NO. \_\_\_\_\_  
FOR \_\_\_\_\_ SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_ SHEETS  
COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_



C-4

Data for Dam at Outlet of Subarea A-1  
(see Sketch on Sheet C-4)

Name of Dam: Pine View Dam

Height: 13 feet (existing) No outlet works

Spillway Data:	Existing Conditions	Design Conditions
----------------	---------------------	-------------------

Top of Dam Elevation	<u>1445.7</u>	<u>N/A</u>
----------------------	---------------	------------

Spillway Crest Elevation	<u>1444.0</u>	<u>N/A</u>
--------------------------	---------------	------------

Spillway Head Available (ft)	<u>17</u>	<u>N/A</u>
------------------------------	-----------	------------

Type Spillway	<u>See Sketch Next Sheet</u>	
---------------	------------------------------	--

"C" Value - Spillway	<u>N/A</u>	<u>N/A</u>
----------------------	------------	------------

Crest Length - Spillway (ft)	<u>N/A</u>	<u>N/A</u>
------------------------------	------------	------------

<u>Spillway</u> Peak Discharge (cfs)	<u>65</u>	<u>N/A</u>
--------------------------------------	-----------	------------

Auxiliary Spillway Crest Elevation	<u>N/A</u>	<u>N/A</u>
------------------------------------	------------	------------

Auxiliary Spillway Head Available (ft)	<u>N/A</u>	<u>N/A</u>
--	------------	------------

Type Auxiliary Spillway	<u>None</u>	
-------------------------	-------------	--

"C" Value - Auxiliary Spillway	<u>N/A</u>	<u>N/A</u>
--------------------------------	------------	------------

Crest Length - Auxiliary Spillway (ft)	<u>N/A</u>	<u>N/A</u>
--	------------	------------

<u>Auxiliary Spillway</u>		
---------------------------	--	--

Peak Discharge (cfs)	<u>N/A</u>	<u>N/A</u>
----------------------	------------	------------

<u>Combined Spillway</u> Discharge (cfs)	<u>65</u>	<u>N/A</u>
--	-----------	------------

Spillway Rating Curve: See Computations Sheets C-6 to C-9

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)
-----------	------------------	----------------------------	----------------

<u>1444</u>	<u>0</u>	<u>N/A</u>	<u>0</u>
-------------	----------	------------	----------

<u>1445</u>	<u>36</u>	<u>N/A</u>	<u>36</u>
-------------	-----------	------------	-----------

<u>1446</u>	<u>89</u>	<u>N/A</u>	<u>89</u>
-------------	-----------	------------	-----------

<u>1448</u>	<u>275</u>	<u>N/A</u>	<u>275</u>
-------------	------------	------------	------------

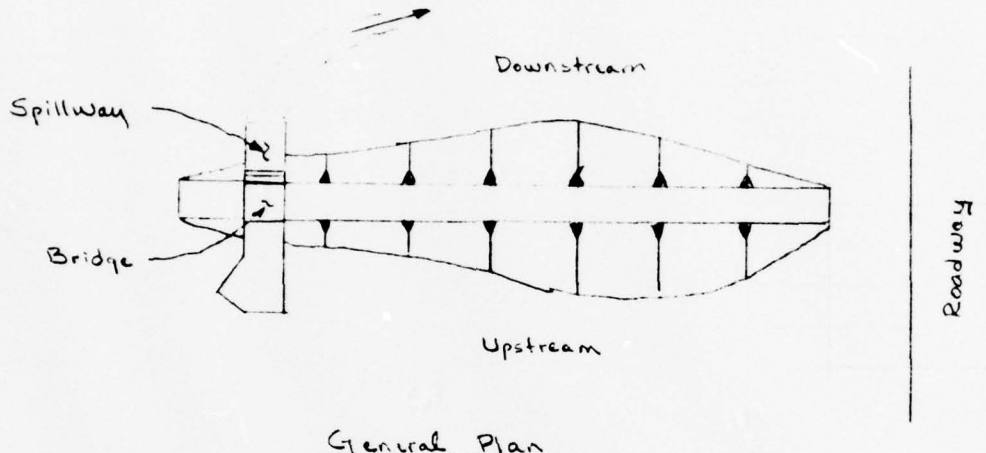
<u>1450</u>	<u>457</u>	<u>N/A</u>	<u>457</u>
-------------	------------	------------	------------

<u>1455</u>	<u>1027</u>	<u>N/A</u>	<u>1027</u>
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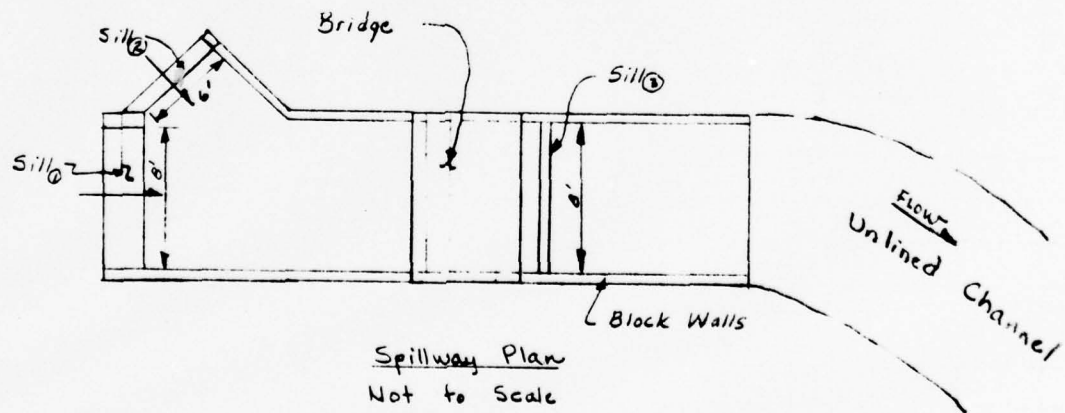
GANNETT FLEMING CORDRY  
AND CARPENTER, INC.  
HARRISBURG, PA.

SUBJECT Discharge Rating for FILE NO. \_\_\_\_\_  
Pine View Dam SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_ SHEETS  
FOR \_\_\_\_\_  
COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

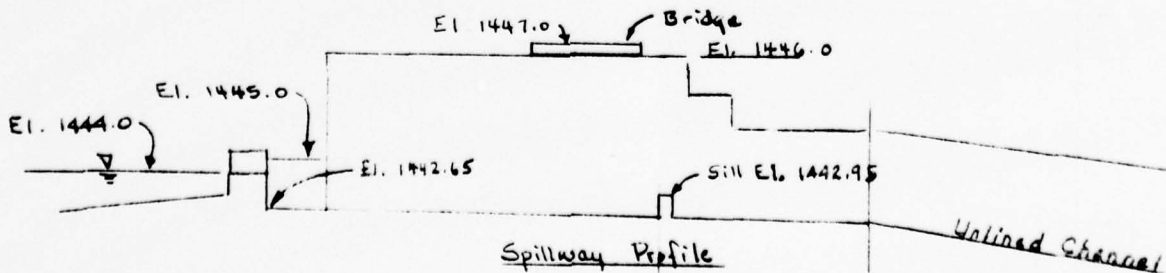
Sketches of conditions @ Pine View Dam:



General Plan  
Not to Scale



Spillway Plan  
Not to Scale



Spillway Profile  
Not to Scale

C-6

Discussion of Hydraulic Control:

Visual inspection of the spillway structure at Pine View Dam indicated the following:

1. Low flow control would be at the two sills at the upstream end. As flow increases, control will shift to the sill on the downstream side of the bridge.
2. Bridge will be easily washed out and has no effect.

Method of determining discharge rating:

1. Compute rating curve for sills at upstream and downstream ends of spillway.
2. During overtopping, dam will not be assumed to fail. Although this assumption might not be accurate, this method is used by computer to evaluate the spillway capacity of Sunrise Lake Dam. It would not be appropriate for evaluating Pine View Dam.

Note: Profile across dam and spillway are on next sheet.

SUBJECT Discharge Rating for FILE NO. \_\_\_\_\_  
Pine View Dam SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_ SHEETS  
 FOR \_\_\_\_\_  
 COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_





GANNETT FLEMING CORDRY  
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SUBJECT Discharge Rating for FILE NO. \_\_\_\_\_  
Pine View Dam SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_ SHEETS  
FOR \_\_\_\_\_  
COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

Pool El	$d_{c1}$	$d_{c2}$	$d_{c3}$	$Q_1$	$Q_2$	$Q_1 + Q_2$	$Q_3$
1444	0	0	0	0	0	0	0
1445	0.67	0	1.33	26	0	26	90
1445.7	1.13	0.47	1.60	54	11	65	110
1446	1.33	0.67	2.00	70	19	89	120
1447	2.00	1.33	2.67	128	52	180	148
1448	2.67	2.00	3.33	198	96	294	275
1450	4.00	3.33	4.67	363	201	570	457
1455			8.00				1027

$d_{c1}$  = CRITICAL depth AT SILL ①

$d_{c2}$  = " " " SILL ②

$d_{c3}$  = " " " SILL ③

FOR LOCATION OF SILLS SEE PAGE C-6

$Q_m$  is discharge AT SILL ①

CONTROL is LESSER discharge  
OF  $(Q_1 + Q_2)$  OR  $Q_3$



Delaware River Basin

Name of Stream: Pine Creek

Name of Dam: Sunrise Lake Dam

NDS ID No.: PA-00556

DER ID No.: 40-216

Latitude: N 41° 06' 25" Longitude: W 75° 45' 35"

Drainage Area: 3.4 sq. mile

Data for Subarea: A-1 (see Sketch on Sheet C-4)

Name of Dam at Outlet of Subarea: Pine View Dam

Drainage Area of Subarea: 0.9 sq. mile

Subarea Characteristics:

Assumed Losses: 1.0-inch initial abstraction + 0.05 in/hr

The following are measured from outlet of subarea to the point noted:

L = Length of Main Watercourse extended to the divide = 2.2 mile

L<sub>CA</sub> = Length of Main Watercourse to the centroid = 0.9 mile

From NAB Data: Area 2, Plate B

C<sub>p</sub> = 0.45

C<sub>T</sub> = 2.1

T<sub>p</sub> = C<sub>T</sub> × (L × L<sub>CA</sub>)<sup>0.3</sup> = 2.6 (hrs)

Flow at Start of Storm = 1.5 cfs/sq. mile × Subarea D.A = 1.4 cfs

Computer Data:

QRCSN = -0.05 (5% of peak flow)

RTIOR = 2.0

Remarks: \_\_\_\_\_

Data for Dam at Outlet of Subarea A-2  
(see Sketch on Sheet C-4)

Name of Dam: Sunrise Lake Dam

Height: 27 (existing)

Spillway Data:	Existing Conditions	Design Conditions
Top of Dam Elevation	<u>1307.0</u>	<u>1308.0</u>
Spillway Crest Elevation	<u>1300.75</u>	<u>1300.75</u>
Spillway Head Available (ft)	<u>6.25</u>	<u>7.25</u>
Type Spillway <u>Concrete ogee weir and chute</u>		
"C" Value - Spillway	<u>3.88</u>	<u>3.88 *</u>
Crest Length - Spillway (ft)	<u>105</u>	<u>105</u>
Spillway Peak Discharge (cfs)	<u>6,660</u>	<u>8,320</u>
Auxiliary Spillway Crest Elevation	<u>N/A</u>	<u>N/A</u>
Auxiliary Spillway Head Available (ft)	<u>N/A</u>	<u>N/A</u>
Type Auxiliary Spillway <u>None</u>		
"C" Value - Auxiliary Spillway	<u>N/A</u>	<u>N/A</u>
Crest Length - Auxiliary Spillway (ft)	<u>N/A</u>	<u>N/A</u>
<u>Auxiliary Spillway</u>		
Peak Discharge (cfs)	<u>N/A</u>	<u>N/A</u>
Combined Spillway Discharge (cfs)	<u>6,660</u>	<u>8,320</u>

Spillway Rating Curve: See next sheet \* From DER files

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)
<u>1300.75</u>	<u>0</u>	<u>0</u>	<u>0</u>
<u>1302.0</u>	<u>495</u>	<u>0</u>	<u>495</u>
<u>1304.0</u>	<u>2,320</u>	<u>0</u>	<u>2,320</u>
<u>1306.0</u>	<u>5,080</u>	<u>0</u>	<u>5,080</u>
<u>1307.0</u>	<u>6,660</u>	<u>0</u>	<u>6,660</u>
<u>1308.0</u>	<u>8,320</u>	<u>0</u>	<u>8,320</u>
<u>1310.0</u>	<u>11,990</u>	<u>0</u>	<u>11,990</u>

GANNETT FLEMING CORDRY  
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HARRISBURG, PA.

SUBJECT Spillway Rating - FILE NO. \_\_\_\_\_  
Sunrise Lake Dam SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_ SHEETS  
FOR \_\_\_\_\_  
COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

Files did not provide a spillway rating curve or ogee dimensions for spillway at Sunrise Lake Dam.

Assume design head = 4.75 feet (reported as proposed design head in preliminary submission)

Spillway crest elevation = 1300.75  
Design pool elevation = 1305.50  
Approach channel elevation = 1297.0  
Top of dam elevation = 1307.0 (existing)  
Top of dam elevation = 1308.0 (design)  
Crest length = 105.0 feet

Using HDC\* Chart 122-1, Low Ogee Crests,  
Discharge Coefficients, Approach Depth Effects:  
\* HDC: HYDRAULIC DESIGN CRITERIA, WATERWAYS EXPERIMENT STATION  
p = height of crest above approach channel = 3.75 feet  
Hd = design head = 4.75 feet

$$p/H_d = 3.75/4.75 = 0.79$$

Pool El	Rating Curve		C	Q
	H <sub>a</sub>	H <sub>a</sub> /H <sub>d</sub>		
1300.75	0.00	0.00	3.10	0 cfs
1301.00	0.25	0.05	3.15	41
1302.00	1.25	0.26	3.37	495
1303.00	2.25	0.47	3.58	1,269
1304.00	3.25	0.68	3.77	2,319
1305.00	4.25	0.89	3.92	3,606
1306.00	5.25	1.10	4.02	5,078
1307.00	6.25	1.32	4.06	6,661
1308.00	7.25	1.53	4.06	8,322
1310.00	9.25	1.94	4.06	11,993



Data for Dam at Outlet of Subarea A-2

Name of Dam: Sunrise Lake Dam

Outlet Works Rating:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet	<u>1283.5</u>		
Invert of Inlet	<u>1284.5</u>		
Type	<u>RCP</u>		
Diameter (ft) = D	<u>3.0</u>		
Length (ft) = L	<u>100.0</u>		
Area (sq. ft) = A	<u>7.07</u>		
N	<u>0.011</u>		
K Entrance	<u>0.5</u>		
K Exit	<u>1.0</u>		
K Friction $\star = 29.1 N^2 L / R^{4/3}$	<u>0.5</u>		
Sum of K	<u>2.0</u>		
$(1/K)^{0.5} = C$	<u>0.71</u>		
Maximum Head (ft) = HM	<u>22.5</u>		
$Q = C A \sqrt{2g(HM)} \text{ (cfs)}$	<u>190</u>		
Q Combined (cfs)			

$\star$  R = Hydraulic Radius = (Area/Wetted Perimeter) =  
D/4 for Circular Conduits.

Data for Dam at Outlet of Subarea A-2

Name of Dam: Sunrise Lake Dam

**Storage Data:**

[illegible]
$$\star \text{ ELEV0} = \text{ELEV1} - (3S_1/A_1)$$

**\*\* Planimetered contour at least 10 feet above top of dam**

Reservoir Area at Top of Dam is 2 percent of <sup>uncontrolled</sup> watershed.

Remarks: \_\_\_\_\_

Delaware River Basin

Name of Stream: Pine Creek

Name of Dam: Sunrise Lake Dam

NDS ID No.: PA-00556

DER ID No.: 40-216

Latitude: N 41° 06' 25" Longitude: W 75° 45' 35"

Drainage Area: 3.4 sq. mile

Data for Subarea: A-2 (see Sketch on Sheet C-4)

Name of Dam at Outlet of Subarea: Sunrise Lake Dam

Drainage Area of Subarea: 2.5 sq. mile

Subarea Characteristics:

Assumed Losses: 1.0-inch initial abstraction + 0.05 in/hr

The following are measured from outlet of subarea to the point noted:

L = Length of Main Watercourse extended to the divide = 3.2 mile

L<sub>CA</sub> = Length of Main Watercourse to the centroid = 1.5 mile

From NAB Data:

C<sub>p</sub> = 0.45

C<sub>T</sub> = 2.1

T<sub>p</sub> = C<sub>T</sub> × (L × L<sub>CA</sub>)<sup>0.3</sup> = 3.4 (hrs)

Flow at Start of Storm = 1.5 cfs/sq. mile × Subarea D.A. = 3.75 cfs

Computer Data:

QRCSN = -0.05 (5% of peak flow)

RTIOR = 2.0

Remarks: \_\_\_\_\_

72 hours

N/A

96 hours

N/A

C-3

GANNETT FLEMING CORDRY  
AND CARPENTER, INC.  
HARRISBURG, PA.

SUBJECT \_\_\_\_\_ FILE NO. \_\_\_\_\_  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_ SHEETS  
FOR \_\_\_\_\_  
COMPUTED BY \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

Selected Computer Output

<u>Item</u>	<u>Page</u>
Input Data	C-18
Summary of Peak Flows	C-20
Pine View Dam	C-21
Sunrise Lake Dam	C-22

C-17

\*\*\*\*\*  
 FLOOD HYDROGRAPH PACKAGE (HFC-1)  
 DAM SAFETY VERSION JULY 1978  
 LAST MODIFICATION 26 FEB 79  
 \*\*\*\*\*

NATIONAL DAM INSPECTION PROGRAM									
PINE CREEK									
SUNRISE LAKE DAM									
	A1	A2	A3	B	C1	C2	C3	C4	C5
1	300	0	15	0	0	0	0	0	0
2	5	3	1	0	0	0	0	0	0
3	1	0.75	0.50	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0
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22	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0
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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLANETATIC ECONOMIC COMPUTATIONS  
FLOWS IN CUBIC FEET PER SECOND (CFS) IN WATERS FOR SECOND  
AREA IN SQUARE MILES (SQ. MI.) IN WATERS FOR SECOND

OPERATION	STATION	AREA	PLAN	RATIO 1 1.00	RATIO 2 0.75	RATIO APPLIED TO FLOW RATIO 3 0.66
HYDROGRAPH AT	1	2.33	1	2076	2202	1444
ROUTED TO	1	2.33	1	41.15	62.36	41.87
ROUTED TO	2	2.33	1	2004	2175	1465
ROUTED TO	2	2.33	1	20.23	61.50	40.91
ROUTED TO	3	2.33	1	2003	2173	1479
ROUTED TO	3	2.33	1	20.27	61.52	40.75
HYDROGRAPH AT	4	2.50	1	2873	2141	1419
ROUTED TO	4	2.50	1	91.35	50.03	40.17
2 COMBINED	4	2.50	1	3643	2772	1422
ROUTED TO	4	2.50	1	103.16	77.37	51.56
ROUTED TO	4	2.50	1	6046	4554	3046
ROUTED TO	4	2.50	1	171.19	128.96	80.28
ROUTED TO	4	2.50	1	6010	4517	3025
ROUTED TO	4	2.50	1	170.17	127.91	85.65

SUMMARY OF DAM SAFETY ANALYSIS

PINE VIEW DAM

PLAN 1 .....		ELEVATION		INITIAL VALUE		SPILLWAY CREST		TOP OF DAM	
RATIO OF PMF		RESERVOIR STORAGE		MAXIMUM STORAGE		MAXIMUM OUTFLOW		MAX OUTFLOW	
1.00		1447.72		225		2064		1447.72	
.75		1447.45		224		2175		1447.72	
.50		1447.13		212		1445		1447.72	
		MAXIMUM DEPTH OVER DAM		MAXIMUM STORAGE AC-FT		MAXIMUM OUTFLOW CFS		DURATION OVER TOP HOURS	
1.00		2.02		225		2064		17.60	
.75		1.75		224		2175		13.75	
.50		1.43		212		1445		11.00	
								TIME OF FAILURE HOURS	
1.00								41.50	
.75								41.50	
.50								41.50	

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
1.00	2905	1366.4	41.50
.75	2175	1365.7	41.50
.50	1439	1364.6	41.50

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
1.00	2473	1321.3	41.75
.75	2141	1320.6	41.75
.50	1419	1320.6	41.75

SUMMARY OF DAM SAFETY ANALYSIS

SUNRISE LAKE DAM

PLAN 1 .....

ELEVATION  
STAGE  
OUTFLOW

INITIAL VALUE  
1300.80  
50.  
0.

SPILLWAY CREST  
1300.80  
50.  
0.

TOP OF DAM  
1307.00  
179.  
660.

RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1306.59	167.	6010.	0.00	42.25	0.00
.75	1305.59	141.	4517.	0.00	42.50	0.00
.50	1304.51	115.	3025.	0.00	42.50	0.00

Summary of Pertinent Results

PMF Rainfall = 25.33 inches

	PMF	1/2 PMF
Runoff (inches)(approx).	23.0	11.5

Pine View Dam:

Inflow (cfs)	2936	1468
Outflow (cfs)	2904	1445
Depth Overtopping (ft)	2.02	1.43
Duration Overtopping (hr.)	17.0	11.0

Sunrise Lake Dam

Inflow (cfs)	6046	3046
Outflow (cfs)	6010	3025
* Freeboard (ft)	0.41	2.49

\* Freeboard based on existing conditions.



DELAWARE RIVER BASIN  
PINE CREEK, LUZERNE COUNTY  
PENNSYLVANIA

SUNRISE LAKE DAM  
NDI ID No. PA-00556  
DER ID No. 40-216

WHITE HAVEN POCONOS OWNERS ASSOCIATION, INC.

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

JULY 1979

APPENDIX D  
PHOTOGRAPHS

SUNRISE LAKE DAM

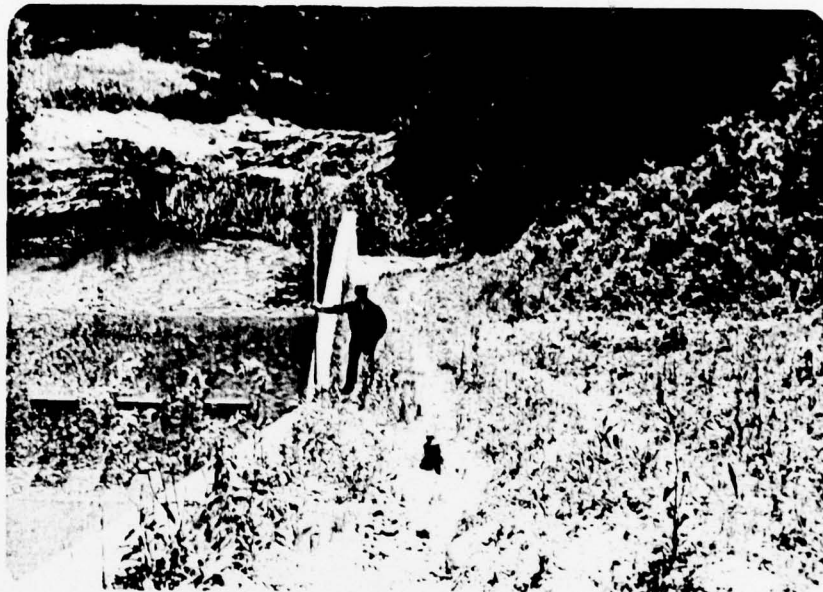


A. Upstream Slope

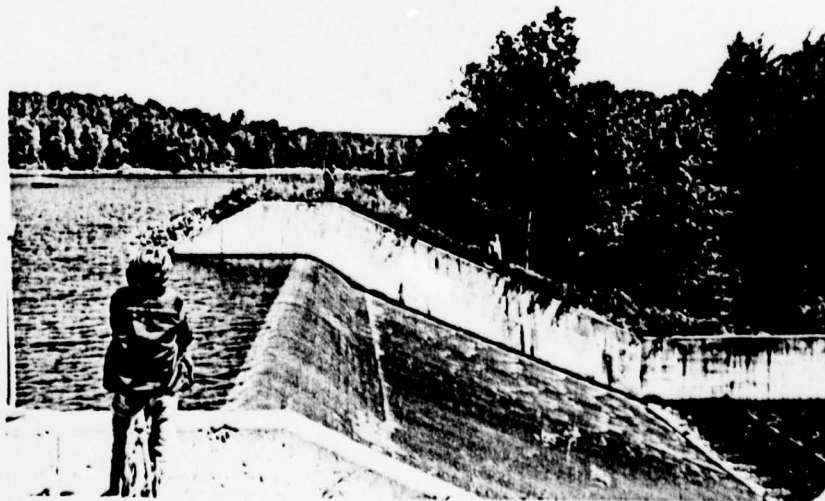


B. Downstream Slope and Left Abutment.

SUNRISE LAKE DAM



C. Downstream Slope and Right Spillway Wall.



D. Embankment and Spillway.

SUNRISE LAKE DAM



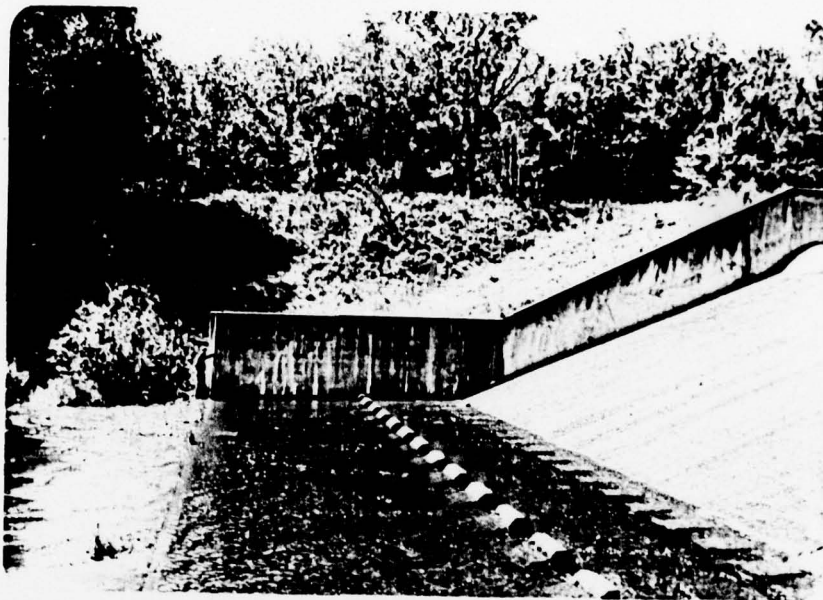
E. Headwall at Conduit Outlet.



F. Spillway Chute and Stilling Basin.



SUNRISE LAKE DAM



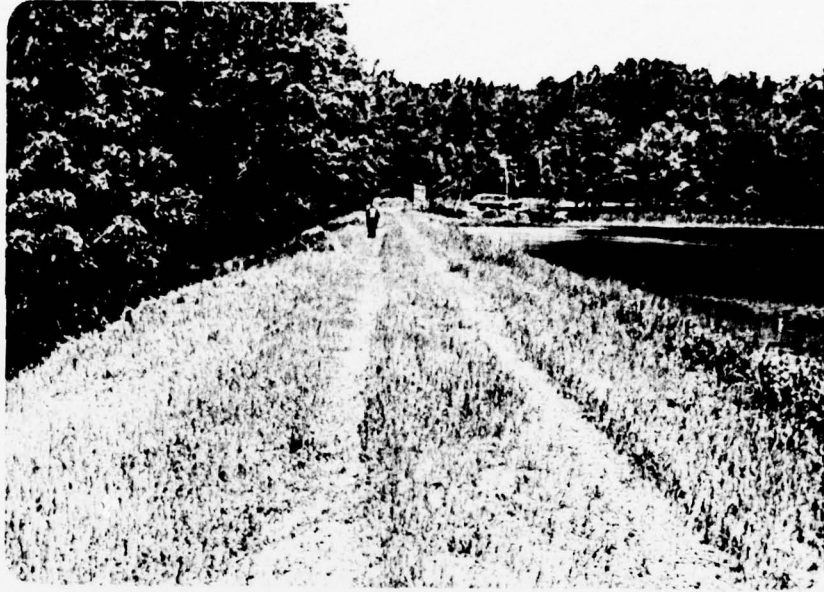
G. Stilling Basin and Right Abutment.



H. Area Downstream from Stilling Basin.



SUNRISE LAKE DAM



J. Pine View Dam - Located 1.3 Miles Upstream.



K. Spillway Structure at Pine View Dam.

DELAWARE RIVER BASIN  
PINE CREEK, LUZERNE COUNTY  
PENNSYLVANIA

SUNRISE LAKE DAM

NDI ID No. PA-00556  
DER ID No. 40-216

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APPENDIX E

GEOLOGY

## SUNRISE LAKE DAM

### APPENDIX E

#### GEOLOGY

1. General Geology. The damsite and reservoir are located in Luzerne County. The rock formations exposed in Luzerne County range from the Post-Pottsville formations, of Pennsylvanian Age, down to the Onondaga formation, of Middle Devonian Age. The Wisconsin terminal moraine crosses the southern part of the County, and the greater part of the County is covered by glacial drift. Extensive deposits of glacial outwash occur along the Susquehanna River and less extensive deposits along the smaller streams.

Nearly all of Luzerne county lies in the Valley and Ridge Province in which nearly all the rocks have been strongly folded. In going from north to south across the County, five major folds are encountered, all of which trend northeast. The first of these is a shallow syncline on the crest of the North Mountain, forming the Mehoopnay coal basin. The second is the Milton Anticline, which exposes the Portage group in the northwestern part of the County and gradually flattens out toward the northeast. The third and most pronounced is the Lackawanna Syncline, which originates in Lackawanna County to the north, and has preserved the Post-Pottsville formations throughout the Wyoming Valley. The maximum depth of this syncline is reached in the vicinity of Wilkes-Barre and Plymouth. The double rim of this syncline is formed by the resistant Pottsville formation and Pocono sandstone, separated by the less resistant Mauch Chunk shale. The fourth fold is the Berwick (Montour) Anticline, which exposes a few feet of the Onondaga formation in the vicinity of Beach Haven. This fold reaches its maximum development farther west and only the eastern portion reaches Luzerne County. The fifth major fold comprises a series of anticlines and synclines forming the Eastern Middle Anthracite Field in the vicinity of Hazleton. The synclinal basins in this region are relatively shallow and there are large areas from which all coalbeds have been eroded.

The general dips of the region vary from 0° to 40°, and the maximum dips are found on the rims and within

The Catskill and Shawangunk Post-Cretaceous rocks in their cores are severely folded and intersected with numerous minor faults. The northern and easternmost parts of the County border the Appalachian Plateau Province and are characterized by horizontal, or nearly horizontal strata. The Catskill continental group of rocks underlies those parts of Luzerne County that are outside of the five major fields.

2. Site Geology. Sunrise Lake Dam is situated on the Pocono sandstone of late Mississippian age. The Pocono formation is composed primarily of fine to coarse grained conglomerate and gray, medium to coarse grained sandstone with some interbedded shales. The bedding is well developed and is moderate to thick with crossbedding common. Joints are well developed, open and usually steeply dipping or vertical. The Pocono sandstone is highly resistant to weathering and is a major ridge former in the area. Structure is typical of the valley and ridge province with ridges striking to the Northeast and dipping steeply to the northwest in the area.

Most of the dam is founded on natural overburden.



